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VOL III - PART 5

FULL-SCALE INCINERATION SYSTEM DEMONSTRATION VERIFICATION TEST BURNS AT THE NAVAL BATTALION CONSTRUCTION CENTER, GULFPORT, MISSISSIPPI - VOL III: TREATABILITY TESTS PART 5

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This technical report is divided into eight volumes. This portion of the report comprises Volume II, which is further subdivided into 5 parts, including the appendixes. This volume describes the verification test burns conducted on a 100 ton/day mobile incinerator that was used to process soil contamination with the constituents of Herbicide Orange, namely 2,4,5-T, 2,4-D, and trace quantities of dioxin. The demonstration was conducted at the Naval Construction Battalion Center in Gulfport, Mississippi. This volume provides specific details concerning the planning efforts and data results from the test burns. Project managers and field engineers responsible for planning and implementation of hazardous waste remedial actions should find the information contained herein very useful.

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PREFACE

This report was prepared by EG&G Idaho, Inc., P. O. Box 1625, Idaho Falls, ID 83415, under Job Order Number (JON) 2103 9027, for the Air Force Engineering and Services Center, Engineering and Services Laboratory, Tyndall Air Force Base, Florida 32403-6001.

This report summarizes work done between September 1986 and December 1986. Major Terry Stoddart and Major Michael L. Shelley were the AFESC/RDVS Project Officers.

The information contained in this volume describes the events, the planning efforts, and the data results of a test burn conducted on a 100 ton/day mobile incinerator that was used to process soil contaminated with constituents of herbicide orange. This volume is subdivided into five parts; Part 1 contains the final report on the verification test burns, Parts 2 through 5 contain the appendixes. Volumes I and III through VIII describe the incinerator operations, the soil excavation activities, and the additional testing required by the Environmental Protection Agency.

This report has been reviewed by the Public Affairs Office (PA) and is releasable to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

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LIST OF APPENDIXES

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APPENDIX U

REVIEW/EVALUATION OF ANALYTICAL DATA FOR SAMPLES FROM NWP-2000 INCINERATOR SYSTEM VERIFICATION TEST BURNS AT NCBC

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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APPENDIX U

REVIEW/EVALUATION OF ANALYTICAL DATA FOR SAMPLES FROM MWP-2000 INCINERATOR SYSTEM VERIFICATION TEST BURNS AT NCBC

1. Summary

The analytical laboratory used for the project was IT Analytical Services (ITAS) of Knoxville, Tennessee, which performed all required analyses, including analyses for polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs), selected organics and selected inorganics. Table U-1 provides a summary of the overall analytical plan including the analyte classes of interest, the matrices analyzed for each analyte and the analytical methods employed.

Samples were received by ITAS in three separate shipments on December 9, 17, and 18, 1986. EG&G Idaho, Inc., Chemical Sciences personnel were present at the laboratory during the period when the last two shipments were received providing laboratory oversight and an interface between sampling operations in the field and the laboratory.

ITAS provided complete data packages (References U.1 and U.2), within the requirements of the Contract Laboratory Program (CLP) where appropriate, for all samples. Where CLP protocols were not directly applicable, ITAS provided documentation consistent with the CLP guidelines. Upon receipt the analytical results were reviewed by Chemical Sciences personnel for completeness and adherence to the appropriate protocols. For the dioxins and furans, the review was against the ITAS SOPs since there were no directly applicable EPA methodologies. For the inorganics and organics review was against the appropriate Contract Compliance Screening Procedure (CCSP) where applicable. For inorganics the CCSP used was "Contract Compliance Screening Evaluation Listing for RAS Inorganic Under SOW 784," while for organics "Contract Compliance Screening Procedures for RAS Organics, Revised 5/86," was used.

Table 6-1. Summary of Analytical Methods Used for Samples from Incineration Verification Test Burns at NEBC

Analyte	Matrix	Method	Description
2,3,7,8-TCDD	Water	ITAS SOP[a]	U.S. EPA CLP[b] plus Method 8280[c] modified for HRGC/HRMS
	Soil	ITAS SOP[a]	U.S. EPA CLP[b] plus Method 8280[c] modified for HRGC/HRMS
	Stack gas	ITAS SOP[a]	U.S. EPA CLP[b] plus Method 8280[c] modified for HRGC/HRMS
PCDD/PCDF (total)	Water	ITAS SOP[a]	U.S. EPA CLP[b] plus Method 8280[c] modified for HRGC/HRMS
	Soil	ITAS SOP[a]	U.S. EPA CLP[b] plus Method 8280[c] modified for HRGC/HRMS
	Stack gas	ITAS SOP[a]	U.S. EPA CLP[b] plus Method 8280[c] modified for HRGC/HRMS
Extractable organics (acid and base/ neutral)	Water	U.S. EPA CLP SOW[d]	L/L extraction, GC/MS analysis
	Soil	U.S. EPA CLP SOW[d]	Sonication extraction, GC/MS analysis
	Stack gas	Methods 3510, 3540,[c] U.S. EPA CLP SOW[d]	L/L and Soxshlet extraction, combine extracts and analyze per CLP
PAHs	Water	Method 8310[c]	L/L extraction, HPLC analysis
	Soil	Methods 3540, 3550 and 8310[c]	Soxhlet or sonification extraction, HPLC analysis
	Stack gas	Methods 3510, 3540 and 8310[c]	L/L and Soxhlet extraction, combine extracts, HPLC analysis
Toxaphene/PCBs	Water	U.S. EPA CLP SOW[d]	L/L extraction, GC/MS analysis
	Soil	U.S. EPA CLP SOW[d]	Sonication extraction, GC/MS analysis
	Stack gas	Methods 3510, 3540,[c] U.S. EPA CLP SOW[d]	L/L and Soxhlet extraction, combine extracts and analyze per CLP
Herbicides	Water	Method 8150[c]	Extraction, methylation, GC/EC
	Soil	Method 8150[c]	Extraction, methylation, GC/EC
	Stack gas	Methods 3510, 3540, and 8150[c]	L/L and Soxhlet extraction, combine and methylate extracts, GC/EC
Metals	Water	U.S. EPA CLP SOW[e]	Digestion, AA or GFAA analysis
	Soil	U.S. EPA CLP SOW[e]	Digestion, AA or GFAA analysis
PICs	VOST	Method 3720	Thermal disorption, GC/MS
	MM5	Methods 3510, 3540,[c] and U.S. EPA CLP SOW[d]	L/L and Soxhlet extraction, combine extracts and analyze per CLP

a. See Appendix Q for ITAS SOPs.

b. See Appendix R for U.S. EPA CLP required detection limits..

c. Methods from EPA SW-846 (Reference 27)

d. Statement of Work, "Organic Analysis, Multi-Media, Multi-Concentration," July 1985 Revision.

e. Statement of Work, "Inorganic Analysis, Multi-Media, Multi-Concentration," SOW No. 785, July 1985.

Where review of the results by EG&G Idaho, Inc. generated questions or comments, these were summarized and submitted in writing to ITAS for resolution. The comments as submitted to ITAS are shown in Reference U.3. The written response from ITAS regarding the comments on the PCDD/PCDF results, dated April 3, 1987, is presented in Reference U.4. The corresponding response on the inorganic/organic results is presented in Reference U.5.

The PCDD/PCDF results were evaluated as being acceptable within the guidelines of the SOPs used after the EG&G Idaho comments were addressed by ITAS. Organic and inorganic results were evaluated as being acceptable. Violation of holding times for three VOST samples and five reextractions of extractable organics were not judged to have significant impact on the results where this occurred. Detailed review discussion for PCDD/PCDF, volatile organics, polynuclear aromatic hydrocarbons (PAHs), extractable organics (base neutrals/acids), pesticides and polychlorinated biphenyls (PCBs), herbicides, and inorganics follows and is based upon the ITAS analytical reports (References U.1 and U.2) as expanded upon by the EG&G Idaho, Inc. review (References U.3, U.4, and U.5).

2. Dioxins/Furans

All of the PCDD/PCDF data (Reference U.1), including the isomer specific results, were reviewed. This included reviewing the chromatograms, checking calculations, checking peak ratios, checking calibrations and response factors, checking for completeness and checking the results against the appropriate ITAS SOPs to verify that they were adhered to and, in particular, that the QA/QC requirements were met. As discussed above, review of the results generated comments and questions which were summarized and submitted to ITAS for resolution. The comments pertinent to the PCDDs/PCDFs are listed as part of Reference U.3 under Category 4. ITAS, as requested, responded to each comment in writing. The response, dated April 3, 1987, is presented in Reference U.4. The response adequately addressed each comment.

Table U-2 presents a QA summary for the PCDD/PCDF results obtained by low resolution mass spectrometry and Table U-3 presents a similar summary for the PCDD/PCDF results obtained by high resolution mass spectrometry. All results were within bounds except for surrogate recovery of pentachlorodibenzofuran (PeCDF) in one sample (FS-6) by low resolution and both duplicate precision and spike recovery accuracy for octachlorodibenzo-p-dioxin (OCDD) by high resolution. Neither of these outliers presents a significant problem. The surrogate recovery for the PeCDF was not significantly out-of-bounds. Furthermore, PeCDF was not detected in any of the samples, so it was not of particular concern in any event. The outliers associated with OCDD may have been caused by low levels of background OCDD contamination as found in some laboratory blanks. In any event, OCDD was not of particular concern since its presence at low levels in various of the samples had been previously ascribed as being possibly because of similar background contamination.

In summary, all of the ITAS PCDD/PCDF results were evaluated as being acceptable within the guidelines of the SOPs used after the comments were addressed.

3. Volatile Organics

The samples submitted to ITAS for volatile organics analysis are listed in Table U-4. Samples 14799-14805 and 14800-14803 VOST tube runs were lost due to instrument failure during analysis.

Instrument instability required recalibration and delayed the analysis of VOST-1-C, 2-C and 3-C until 6 days past the 14 day period from receipt. However, the results are similar to those for runs VOST 5-C and 6-C which were run within this holding time.

The volatiles data were reviewed against the guidelines and requirements of the organics CCSP referenced previously. This review included checks for completeness, adherence to protocols and selected checks of calculations. The comments and questions generated by the review

Table U-2. PCDD/PCDF QA/QC Report (LRMS)

Surrogate Percent Accuracy	^{37}Cl-TCDD	^{13}C-PeCDD	^{13}C-PeCDF	^{13}C-HpCDD	^{13}C-OCDD
Number of Data Points	7	7	7	7	7
Mean Percent Accuracy	100.8%	96.3%	125%	93.7%	89.4%
Range	88-116%	52-133%	93-166%[a]	54-130%	61-120%
EPA Range	60-140%	40-160%	40-160%	40-160%	40-160%

a. One sample (FS-6) was outside the IT QA/QC limit. These limits were established by IT and are not EPA ranges.

Table U-3. PCDD/PCDF QA/QC Report (HRMS)

Surrogate Percent Accuracy ^{37}Cl-TCDD

Number of Data Points	30
Mean Percent Accuracy	97.8%
Range	79-126%

EPA Range = 60-140%

Sample ID [EMT 2]

Precision of Duplicates	HpCDD	OCDD
Original Value (b)	0.0053	0.060
Duplicate Value (a)	0.0052	0.044
Precision = $\frac{a-b}{\frac{a+b}{2}} \times 100\%$	1.9%	30.8%

EPA Range = 50%

Accuracy of Spike	TCDD	HxCDD	OCDD	TCDF	HxCDF	OCDF
Original Value (a)	ND	ND	0.060	ND	ND	ND
Spike Value (b)	1.35	0.99	0.75	1.40	1.1	0.66
Spike Level (c)	1.0	1.0	1.0	1.0	1.0	1.0
Accuracy = $\frac{b}{a+c} \times 100\%$	135%	99%	70.8%	140%	110%	66%

EPA Range = 60-140%

Sample ID [WB1][a]

Precision of Duplicates	OCDD
Original Value (b)	0.071
Duplicate Value (a)	0.078
Precision $\frac{a-b}{\frac{a+b}{2}} \times 100\%$	9.3%

EPA Range = 50%

Table U-3. PCDD/PCDF QA/QC Report (HRMS) (continued)

		TCDD	HxCDD	OCDD	TCDF	HxCDF	OCDF
Accuracy of Spike							
Original Value (a)	=	ND	ND	22.7	6.7	ND	ND
Spike Value (b)	=	51.6	31.9	29.2	46.8	38.9	27.
Spike Level (c)	=	40.0	40.0	40.0	40.0	40.0	40.0
Accuracy = $\frac{b}{a+c} \times 100\%$	=	129%	80%	47%	100%	97%	69%

EPA Range = 60-140%

a. HpCDD found in duplicate and spike below the "ND" level found in original.

b. HpCDF found in original at a level near the "ND" levels found in the duplicate and spike.

c. OCDD was found in some of the laboratory blanks. This contamination may be the cause of the low level of precision of this sample.

Table U-4. Volatile organics (VOST) Sample Identification

Case #	Sample #	Client #	Sam. Type[a]
EGG23549	AA5859	VOST-1-C	12
	AA5860	VOST-2-C	12
	AA5861	VOST-3-C	12
	AA5862	17939	61
	AA5863	17940	61
	AA5864	17941	61
	AA5865	17942	61
	AA5866	17943	61
	AA5867	17944	61
	AA5868	14793	61
	AA5869	14796	61
	AA5870	14794	61
	AA5871	14797	61
	AA5872	14795	61
	AA5873	14798	61
	AA5874	14799	61
	AA5875	14805	61
	AA5876	14800	61
	AA5877	14803	61
	AA5878	14801	61
	AA5879	14804	61
EGG23612	AA6496	VOST-5-C	12
	AA6497	VOST-6-C	12
	AA6498	14812	61
	AA6499	14815	61
	AA6500	14813	61
	AA6501	14816	61
	AA6502	14814	61
	AA6503	14817	61
	AA6504	17945	61
	AA6505	17948	61
	AA6506	17946	61
	AA6507	17949	61
	AA6508	17947	61
	AA6509	17950	61
	AA6510	Tenax blank	61
	AA6511	Charcoal blank	61

a. Sam. type: 12 = VOST condensate, 61 = VOST tube

are listed as part of Reference U.3 under Category 1. The written ITAS response is contained in a letter dated April 14, 1987, which is presented as Reference U.5. The response adequately addresses each comment.

In summary, the ITAS VOST results were evaluated as being acceptable. The violation of holding times was not considered to have significant adverse impact on the results.

4. Polynuclear Aromatics Hydrocarbons

The samples submitted to ITAS for polynuclear aromatic hydrocarbons (PAH) analyses are listed in Table U-5.

Case EGG 23550

Samples AA5912 (FS-1), AA5913 (FS-2), AA5918 (FS-1 QC) and AA5919 (FS-1 QC) were filtered using an 0.45 m syringe filter before injection onto the HPLC column. Due to the matrix of the samples they were prepped and concentrated to approximately five milliliters in acetone. They were then brought to a 10 mL volume using HPLC grade acetonitrile. Samples AA5913, AA5918, and AA5919 could be injected on column at no lower a concentration then one to ten milliliters. This plus the initial high volume of extract multiplied the detection limit by a factor of one hundred.

These samples were also calculated on a wet weight basis.

Case EGG 23609

Samples AA6432 (FS-6) and AA6434 (FS-5) could be injected at no lower a dilution than one to one hundred due to matrix problems. The samples contained an "impurity" which adhered to the HPLC column and required prolonged organic solvent flushes to remove it, although even after subsequent removal and reconditioning, column efficiency was diminished. At this dilution the problem was not so severe.

Table U-5 Polynuclear Aromatic Hydorcarbon (PAH) Sample Identification

Case #	Sample #	Client #	Sam. Type[a]
EGG23548	AA5837	ENT-B	01
	AA5838	ENT-1	01
	AA5839	ENT-2	01
EGG23549	AA5844	VB-1-F	63
	AA5845	VB-2-F	63
	AA5846	VB-3-F	63
	AA5847	VB-1-XAD	61
	AA5848	VB-1-PW	12
	AA5849	VB-1-C	12
	AA5850	VB-2-XAD	61
	AA5851	VB-2-PW	12
	AA5852	VB-2-C	12
	AA5853	VB-3-XAD	61
	AA5854	VB-3-PW	12
	AA5855	VB-3-C	12
EGG23550	AA5912	FS-1	31
	AA5913	FS-2	31
	AA5914	FS-3	31
	AA5915	AD-1	31
	AA5916	AD-2	31
	AA5917	AD-3	31
	AA5918	FS-1 QC	31
	AA5919	FS-1 QC	31
EGG23609	AA6432	FS-6	31
	AA6433	AD-6	31
	AA6434	FS-5	31
	AA6435	AD-5	31
	AA6436	AD-5	31
	AA6437	AD-5	31
	AA6448	BS-1	31
EGG23610	AA6454	ENT-5	01
	AA6457	ENT-6	01
	AA6460	POTW	01
	AA6467	CW	01
	AA6473	WB1	01
EGG23612	AA6487	XAD Blank	61
	AA6488	VB-5-XAD	61
	AA6489	VB-5-PW	12
	AA6490	VB-5-C	12
	AA6491	VB-6-XAD	61
	AA6492	VB-6-PW	12
	AA6493	VB-6-C	12
	AA6512	VB-5-F	63
	AA6513	VB-6-F	63
	AA6814	T Blk 791, Reagent Blk	12

a. Sam. type: 01 = water, 31 = soil, 12,61,63 = stack components

This high dilution combined with the larger extract volume (10 mL) raised the detection limit by a factor of one thousand.

As with the previous organics data, the PAH data were reviewed against the requirements of the organics CCSP referenced previously. The review comments are listed in Reference U.3 under "Other Organic Compounds in Category 1, "and the ITAS response to the respective comments is shown in Reference U.5. The responses adequately address each comment.

In summary, the ITAS PAH results were evaluated as being acceptable.

4. Extractable Organics (Base Neutrals/Acids)

The samples submitted to ITAS for base neutrals/acids (BNA) organics analyses are listed in Table U-6.

Water samples ENT-5, ENT-6, POTW, CW, WB1, along with WB1 matrix spikes were analyzed and found to have low acid surrogate recoveries. These samples were reextracted and reanalyzed with acceptable surrogate results. These data are submitted. The reextraction was outside the usual sample holding time.

The BNA data were reviewed similarly to the other organics results, with the comments listed in Reference U.3 under Category 1 and the corresponding response listed in Reference U.5. The ITAS response was judged to be adequate.

In conclusion, the ITAS BNA results were evaluated as being acceptable. The fact that the reextraction of the samples noted above was outside the usual sample holding time was not judged to have significant adverse impact on the results.

Table U-6. Extractable Organics (BNA) Sample Identification

Case #	Sample #	Client #	Sam. Type[a]
EGG23458	AA5828	ENT-B	01
	AA5829	ENT-1	01
	AA5830	ENT-2	01
EGG23549	AA5844	VB-1-F	63
	AA5845	VB-2-F	63
	AA5846	VB-3-F	63
	AA5847	VB-1-XAD	61
	AA5848	VB-1-PW	12
	AA5849	VB-1-C	12
	AA5850	VB-2-XAD	61
	AA5851	VB-2-PW	12
	AA5852	VB-2-C	12
	AA5853	VB-3-XAD	61
	AA5854	VB-3-PW	12
	AA5855	VB-3-C	12
EGG23550	AA5888	FS-1	31
	AA5889	FS-2	31
	AA5890	FS-3	31
	AA5891	AD-1	31
	AA5892	AD-2	31
	AA5893	AD-3	31
	AA5894	FS-1 QC	31
	AA5895	FS-1 QC	31
EGG23609	AA6414	FS-6	31
	AA6415	AD-6	31
	AA6416	FS-5	31
	AA6417	AD-5	31
	AA6418	AD-5	31
	AA6419	AD-5	31
	AA6445	BS-1	31
EGG13610	AA6451	ENT-5	01
	AA6457	ENT-6	01
	AA6460	POTW	01
	AA6464	CW	01
	AA6470	WB1	01
EGG23612	AA6487	XAD Blank	61
	AA6488	VB-5-XAD	61
	AA6489	VB-5-PW	12
	AA6490	VB-5-C	12
	AA6491	VB-6-XAD	61
	AA6492	VB-6-PW	12
	AA6493	VB-6-C	12
	AA6512	VB-5-F	63
	AA6513	VB-6-F	63
	AA6814	T Blk 791, Reagent Blk	12

a. Sam. type: 01 = water, 31 = soil, 12, 61, 63 = stack components

6. Pesticides and PCBs

The samples submitted to ITAS for pesticide/PCB analyses are listed in Table U-7. Analysis of pesticides was limited to only toxaphene, since the presence of other pesticides was ruled out based on previous findings.

Case EGG 23548

Linearity of toxaphene and Aroclor 1016/1260 mix was run at the beginning of the run. Eval B was run at the beginning and after the fifth sample of the run to check for column degradation. The medium level Aroclor 1016/1260 standard and the medium level toxaphene standard were run at the end.

The Organics Analysis Data Sheet (OADS), page 1 was marked NA in the spaces for the single peak pesticides and for chlordane. Analysis of these compounds was not requested and therefore no analysis was performed.

Case EGG 23549

No method QC samples were prepped with this project.

The samples were composites of stack samples. The units reported were total nanograms (ng). The detection limits were either calculated values or calculated from water Contract Required Detection Limits (CRDLs).

No surrogate was added to these samples.

Samples were analyzed for toxaphene and all the Hazardous Substance List (HSL) aroclors. The remaining compounds on the HSL pesticide list were marked NA on all OADS report forms (Form 1, p. 3) since there was no request for analysis for these compounds.

Table U-7. Pesticide and PCB Sample Identification

Case #	Sample #	Client #	Sam. Type[a]
EGG23548	AA5831	ENT-B	01
	AA5832	ENT-1	01
	AA5833	ENT-2	01
EGG23549	AA5844	VB-1-F	63
	AA5845	VB-2-F	63
	AA5846	VB-3-F	63
	AA5847	VB-1-XAD	61
	AA5848	VB-1-PW	12
	AA5849	VB-1-C	12
	AA5850	VB-2-XAD	61
	AA5851	VB-2-PW	12
	AA5852	VB-2-C	12
	AA5853	VB-3-XAD	61
	AA5854	VB-3-PW	12
	AA5855	VB-3-C	12
EGG23550	AA5896	FS-1	31
	AA5897	FS-2	31
	AA5898	FS-3	31
	AA5899	AD-1	31
	AA5900	AD-2	31
	AA5901	AD-3	31
	AA5902	FS-1 QC	31
	AA5903	FS-1 QC	31
EGG236090	AA6420	FS-6	31
	AA6421	AD-6	31
	AA6422	FS-5	31
	AA6423	AD-5	31
	AA6424	AD-5	31
	AA6425	AD-5	31
	AA6446	BS-1	31
EGG23610	AA6452	ENT-5	01
	AA6457	ENT-6	01
	AA6460	POTW	01
	AA6465	CW	01
	AA6471	WB1	01
EGG23612	AA6487	XAD Blank	61
	AA6488	VB-5-XAD	61
	AA6489	VB-5-PW	12
	AA6490	VB-5-C	12
	AA6491	VB-6-XAD	61
	AA6492	VB-6-PW	12
	AA6493	VB-6-C	12
	AA6512	VB-5-F	63
	AA6513	VB-6-F	63
	AA6814	T Blk 791, Reagent Blk	12

a. Sam. Type: 01 = water, 31 = soil, 12, 61, 63 = stack components

Case EGG 23550

There was an extra blank for the pesticide/PCB samples - a sulfur cleanup blank. Only three of the six soil samples needed sulfur cleanup so a sulfur blank was added (MB2).

Analysis for the single peak pesticides and chlordane was not requested and therefore not performed. The corresponding blanks on the OADS form 1, p. 3 have been marked NA.

Case EGG 23609

Samples were analyzed for toxaphene and all the HSL aroclors. The remaining compounds on the HSL pesticide list were marked NA on all OADS report forms (Form 1, p. 3) since there was no request for analysis for these compounds.

The spiked samples were spiked with 100 ppm Aroclor 1260 standard.

Case EGG 23610

Analysis was done for Toxaphene and the HSL aroclors only. All other compounds were marked NA on the OADS report sheet (Form 1, p. 3) since their analysis was not requested.

The spiked samples POTW-MS and POTW-MSD were spiked with 1.0 ml of a 100 ppm Aroclor 1260 standard.

Case EGG 23612

No method QC samples were prepped with this project.

The samples were composites of stack samples. The units reported were total nanograms (ng). The detection limits were either calculated values or calculated back from water CRDLs.

No surrogate was added to the samples.

Analysis for single peak pesticides and chlordane was not requested and therefore not performed. These were marked NA on the OADS report sheet (Form 1, p. 3).

Review of the toxaphene and PCB data against the guidelines of the organics CCSP resulted in the comments listed in Reference U.3 under Category 1. The ITAS response is listed in Reference U.5. The ITAS response was judged to be adequate to resolve the comments.

In conclusion, the ITAS toxaphene and PCB results were evaluated as being acceptable.

7. Herbicides

The samples submitted to ITAS for herbicide analyses are listed in Table U-8.

The detection limits for soil samples was increased due to matrix interferences. The low level soil and water samples were reprepped in an effort to eliminate these interferences. The interference was determined to be from two different sources. Glassware used to prep the soil samples was found to cause interference due to some sort of residue present. This exhibited itself as a large solvent type peak at the beginning of the chromatograms. The second source of interference was the feed stock samples themselves. These samples contained such high levels of herbicide that any glassware used to prep them exhibited carryover even after the glassware was washed and solvent rinsed. The carryover problem was solved by acid washing, high temperature annealing, and additional solvent rinsing.

Review of the herbicide data was performed in the same manner as that used for the other organics results discussed previously. Review resulted in the comments listed in Reference U.3 under Category 2. The ITAS response, listed in Reference U.5, was considered adequate to address the comments.

Table U-8. Herbicide Sample Identification

Case #	Sample #	Client #	Sam. Type[a]
EGG23548	AA5834	ENT-B	01
	AA5835	ENT-1	01
	AA5836	ENT-2	01
EGG23549	AA5844	VB-1-F	63
	AA5845	VB-2-F	63
	AA5846	VB-3-F	63
	AA5847	VB-1-XAD	61
	AA5848	VB-1-PW	12
	AA5849	VB-1-C	12
	AA5850	VB-2-XAD	61
	AA5851	VB-2-PW	12
	AA5852	VB-2-C	12
	AA5853	VB-3-XAD	61
	AA5854	VB-3-PW	12
	AA5855	VB-3-C	12
EGG23550	AA5904	FS-1	31
	AA5905	FS-2	31
	AA5906	FS-3	31
	AA5907	AD-1	31
	AA5908	AD-2	31
	AA5909	AD-3	31
	AA5910	FS-1 QC	31
	AA5911	FS-1 QC	31
EGG23609	AA6426	FS-6	31
	AA6427	AD-6	31
	AA6428	FS-5	31
	AA6429	AD-5	31
	AA6430	AD-5	31
	AA6431	AD-5	31
	AA6447	BS-1	31
EGG23610	AA6453	ENT-5	01
	AA6457	ENT-6	01
	AA6460	POTW	01
	AA6466	CW	01
	AA6472	WB1	01
EGG23612	AA6487	XAD Blank	61
	AA6488	VB-5-XAD	61
	AA6489	VB-5-PW	12
	AA6490	VB-5-C	12
	AA6491	VB-6-XAD	61
	AA6492	VB-6-PW	12
	AA6493	VB-6-C	12
	AA6512	VB-5-F	63
	AA6513	VB-6-F	63
	AA6814	T Blk 791, Reagent Blk	12

Table U-8. (continued)

Case #	Sample #	Client #	Sam. Type[a]
EGG23611	AA6477	14820	64
	AA6478	14821	64
	AA6479	14822	64
	AA6480	14749	64
	AA6481	17962	64
	AA6482	17963	64
	AA6483	17964	64
	AA6484	17966	64
	AA6485	17967	64
	AA6486	17968	64

a. Sam. type: 01 = water, 31 = soil, 12, 61. 63 = stack components
64 = air filter

In summary, the herbicide data were considered to be acceptable.

8. Inorganics

The samples submitted to ITAS for metals analses are listed in Table U-9, and those submitted for analyses of other inorganic parameters are listed in Table U-10.

Metals normally analyzed by inductively coupled argon plasma spectroscopy (ICAP) were analyzed by atomic absorption spectroscopy due to a malfunctioning ICAP unit.

Lead was detected in preparation blanks for liquid and solid samples at a concentration less than the CRDL and close to the instrument detection limit (IDL): 1.2 micrograms/liter and 2.4 micrograms/liter respectively.

The analysis for the presence of cacodylic acid was based upon determination of arsenic in an organic compound by analysis for total arsenic. A verification of the method was performed as follows:

0.5 grams of $(CH_3)_2AsO_2Na.3H_2O$ were prepared as if the solid were a client submitted solid. The results for arsenic analysis are as follows:

Observed (ppm)	Theoretical (ppm)	% Recovery
1067	877	122

The spike recovery was considered acceptable to confirm the approach.

The following elements were labeled as in nonconformance with respect to spike recovery:

Element	Lab ID #	Client #	Matrix
Pb	AA6455/AA6455-spike	ENT-5	Liquid
Hg	AA6455/AA6455-spike	ENT-5	Liquid
Se	AA6455/AA6455-spike	ENT-5	Liquid
As	AA5920/AA5927	FS-1	Solid

Table U-9. Metals Sample Identification

Case #	Sample #	Client #	Sam. Type[a]
	AA5925	AD-3	31
	AA5926	FS-1 QC	31
	AA5927	FS-1 QC	31
EGG23609	AA6438	FS-6	31
	AA6439	AD-6	31
	AA6440	FS-5	31
	AA6441	AD-5	31
	AA6442	AD-5	31
	AA6443	AD-5	31
	AA6449	BS-1	31
EGG23610	AA6455	ENT-5	01
	AA6458	ENT-6	01
	AA6461	POTW	01
	AA6468	CW	01
	AA6474	WB1	01
	AA6475	BB5	01
	AA6476	BB6	01

a. Sam. type: 01 = water, 31 = soil

Table U-10. Inorganics Sample Identification

Case #	Sample #	Client #	Sam. Type[a]	Test. Desc.
EGG23549	AA5856	VB-1-C1	12	Chloride
	AA5857	VB-2-C1	12	Chloride
	AA5858	VB-3-C1	12	Chloride
EGG23550	AA5923	AD-1	31	Cyanide
				Sulfide
				pH
	AA5924	AD-2	31	Cyanide
				Sulfide
				pH
	AA5925	AD-3	31	Cyanide
				Sulfide
				pH
EGG23609	AA6439	AD-6	31	Cyanide
				Sulfide
				pH
	AA6441	AD-5	31	Cyanide
				Sulfide
				pH
EGG23610	AA6462	POTW, 12-18-86	01	BOD (5-day)
				COD
EGG23612	AA6494	VB-5-C1	12	Chloride
	AA6495	VB-6-C1	12	Chloride
	AA6712	NaOH Blank	12	Chloride

a. Sam. type: 01 = water, 31 = soil, 12 = NaOH

Low recovery factors for the single standard addition method were observed during mercury analysis for the ENT-5 spike. A spike of 0.004 ppm mercury was added because the normal spike of 0.001 ppm could not be seen.

The following elements were labeled as in nonconformance with respect to duplicate preparation:

Element	Lab ID #	Client #	Matrix
Hg	AA6455/AA6455-spike	ENT-5	Liquid
Hg	AA5920/AA5927	FS-1	Solid
Pb	AA5920/AA5927	FS-1	Solid

Review of the inorganics data was performed against the guidelines and requirements of the inorganics CCSP referenced previously to the extent that the guidelines were applicable. No comments resulted from the review. The ITAS data was complete and acceptable as submitted.

Both the spike recovery and duplicate nonconformance were considered to have no significant impact on the metals results. The ITAS inorganics results were considered as acceptable.

9. References

U.1 IT Analytical Services, Final Dioxin and Dibenzofuran Report for EG&G Idaho, Inc., Knoxville, Tennessee, January 16, 1987.

U.2 IT Analytical Services, Analytical Report for USAF NCBC Full Scale Demo--12/86, Gulfport, Mississippi, Knoxville, Tennessee, January 19, 1987.

U.3 Letter, W. Alan Propp (EG&G Idaho, Inc.) to Snell A. Mills (IT Analytical Services), transmittal of IT CCS Summary, February 20, 1987.

U.4 Letter, Bruce F. Wagner (IT Analytical Services) to W. Alan Propp (EG&G Idaho, Inc.) subject pertains to responses on dioxin/furan analysis, April 3, 1987.

U.5 Letter, Tom Wilson and Roger Atchley (IT Analytical Services) to W. Alan Propp (EG&G Idaho, Inc.), subject pertains to responses on organic/inorganic analysis, April 14, 1987.

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APPENDIX V

DRAFT ENVIRONMENTAL ASSESSMENT FOR AN HERBICIDE ORANGE CONTAMINATION DEMONSTRATION AT THE NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MISSISSIPPI

The documents contained in this appendix were published according to their own internal style, which deviates from the Air Force Engineering Services Center format. They have, therefore, been published without editing.

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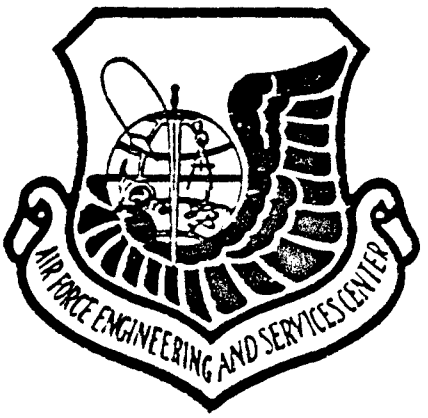

Environmental Assessment for an Herbicide Orange Decontamination Demonstration at the Naval Construction Battalion Center, Gulfport, Mississippi

March 20, 1986

Prepared by
EG&G Idaho, Inc.
for the
United States Air Force

1147

ENVIRONMENTAL ASSESSMENT FOR AN HERBICIDE ORANGE DECONTAMINATION DEMONSTRATION AT THE NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MISSISSIPPI

Prepared by

EG&G Idaho, Inc.
for the
United States Air Force

This document assesses the potential environmental effects of a proposed research, development, and demonstration project that will be conducted under the authority of the United States Air Force. The project involves using a mobile rotary kiln incinerator to process soil contaminated with a toxic substance found in Herbicide Orange, commonly known as dioxin. The purpose of the project is to obtain reliability and maintainability data so that the incinerator's applicability for future site restoration projects may be assessed.

This document was released to the public on March 20, 1986. Comments and requests for information should be submitted before May 28, 1986, to :

Capt. T. L. Stoddart
HQ AFESC/RDVW
Tyndall AFB, FL 32403

SUMMARY

This document is a draft environmental assessment for a proposed research, development, and demonstration project that will be conducted at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. This administrative action is being funded by the United States Air Force and managed by EG&G Idaho, Inc.

The proposed action will use a mobile rotary kiln incinerator to process soil contaminated with trace quantities of 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD), a teratogenic substance commonly known as dioxin, which is found in Herbicide Orange (HO). The soil, which is located at a former HO storage site on NCBC, became contaminated as a result of drum leakage and spillage when the site was used as a staging area for the herbicide before shipment to South Vietnam.

The mobile rotary kiln incinerator will be shipped to the former HO storage site on five tractor trailers. At the site, the incinerator will be erected and first operated using uncontaminated soil to ensure reliable operation. Contaminated soil will then be processed.

The incinerator uses a two-stage process. The first stage employs a rotary kiln to desorb the dioxin from the soil matrix. The second stage completely oxidizes the dioxin and other off-gases. The fully oxidized off-gases are then processed in the air pollution control train and then discharged to the atmosphere.

This document describes the existing environment of the NCBC and Gulfport region. It also describes the potential impacts to the local environment; a finding of no significant impact was determined.

A variety of alternatives that included chemical, thermal, and microbiological processes were considered. Rotary kiln incineration was judged to be the most reliable and economical process to use for a full-scale demonstration project.

Comments on this project and this environmental assessment are being solicited from the Environmental Protection Agency, Region IV, the State of Mississippi, Harrison County, Mississippi, and the general public. Comments should be directed to the person listed on the cover before May 28,1986.

LIST OF ACRONYMS

BOD	Biological oxygen demand
DOD	Department of Defense
EPA	Environmental Protection Agency
ESL	Environmental Sciences Laboratory
gpm	gallons per minute
HCl	hydrochloric
HO	Herbicide Orange
LPG	Liquefied Petroleum Gas
MDWC	Mississippi Department of Wildlife Conservation
NCBC	Naval Construction Battalion Center
NHP	Natural Heritage Program of Mississippi
OEHL	Occupational and Environmental Health Laboratory
PCB	Polychlorinated biphenyl
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
SCC	Secondary Combustion Chamber
TCDD	2,3,4,8-tetrachlorodibenzo-p-dioxin, commonly known as dioxin
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service

TABLE OF CONTENTS

SECTION I
INTRODUCTION

A. OBJECTIVE

This document assesses the environmental impacts of a proposed research, development, and demonstration project to reduce the level of dioxin contamination in soil at a former Herbicide Orange (HO) storage site. The technology to be demonstrated is soil incineration in a mobile rotary kiln incineration system. The main purpose of the demonstration is to provide data on the reliability and maintainability of a rotary kiln incinerator so that cost-effectiveness may be determined for future restoration efforts at other hazardous waste sites. A secondary goal of the demonstration is to reduce the level of HO-derived dioxin at the former HO storage site to meet criteria established by the Environmental Protection Agency.

The proposed project would be conducted on a former HO storage site at the Naval Construction Battalion Center (NCBC) in Gulfport, Mississippi. HO was used as a defoliant during the Vietnam war. The proposed site was used as a staging area for HO before its shipment to South Vietnam. Although all stored HO was incinerated in 1977, some of the HO spilled onto the ground. That HO contained small quantities of a teratogenic contaminant called 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), commonly known as dioxin.

B. BACKGROUND

Herbicide Orange is a reddish brown to tan liquid, soluble in diesel fuel and organic solvents, but insoluble in water. One gallon of HO theoretically contained 4.21 pounds of the active ingredient 2,4-dichlorophenoxyacetic acid (2,4-D) and 4.41 pounds of the active ingredient 2,4,5-trichlorophenoxyacetic acid (2,4,5-T). HO was formulated to contain a 50:50 mixture (by weight) of the n-butyl esters of 2,4-D and 2,4,5-T. The percentages of the formulation typically were as follows:

n-butyl ester of 2,4-D	49.49
free acid of 2,4-D	0.13
n-butyl ester of 2,4,5-T	48.75
free acid of 2,4,5-T	1.00
inert ingredients (e.g., butyl alcohol and ester varieties)	0.63

In April 1970, the Secretaries of Agriculture; Health, Education, and Welfare; and the Interior jointly announced the suspension of certain uses of 2,4,5-T. This suspension resulted from published studies indicating that 2,4,5-T was a teratogen. Subsequent studies revealed that the teratogenic effects resulted from a toxic contaminant in the 2,4,5-T identified as TCDD. Subsequently, the Department of Defense (DOD) suspended the use of HO, which contained 2,4,5-T. At the time of suspension, the U.S. Air Force (USAF) had an inventory of 1.37 million gallons of HO in South Vietnam and 0.85 million gallons at NCBC. In September 1971, the DOD directed that the HO in South Vietnam be returned to the United States and that the entire 2.22 million gallons be disposed in an environmentally safe and efficient manner. The 1.37 million gallons were moved to Johnston Island in the central Pacific in April 1972. The average concentration of dioxin in the HO was about 2 parts per million (ppm), with the total amount of TCDD in the entire HO stock estimated at 44.1 pounds.

Various disposal techniques for HO were investigated from 1971 to 1974. Of those techniques investigated, only high-temperature incineration was sufficiently developed to warrant further investigation. Therefore, during the summer of 1977, the USAF disposed of 2.22 million gallons of HO by high-temperature incineration at sea. This operation, Project PACER HO, was accomplished under very stringent U.S. Environmental Protection Agency (EPA) ocean dumping permit requirements.

During storage and handling at the storage sites, some of the HO was spilled onto the surrounding soil. The soil was therefore contaminated with dioxin. Today, the dioxin contamination on the site ranges from 0 to over 500 ppb; the average concentration is estimated as 20 ppb.

The USAF plan for disposal of the bulk quantities of HO and the EPA permits for the disposal of the herbicide committed the USAF to a follow-up storage site reclamation and environmental monitoring program. The major objectives of that required program were to:

1. Determine the magnitude of HO contamination (TCDD) in and around the former HO test storage sites.

2. Determine the rate of natural degradation for the phenoxy herbicides (2,4-D and 2,4,5-T), their phenolic degradation products, and TCDD in soils of the storage and test sites.

3. Monitor for potential movement of residues from the storage and test sites into adjacent water, sediments, and biological organisms.

4. Recommend managerial techniques for minimizing any impact of the herbicides and dioxin residues on the ecology and human populations near the storage and test sites.

Immediately following the at-sea incineration in 1977, the USAF Occupational and Environmental Health Laboratory (OEHL), which is responsible for routine environmental monitoring, initiated site monitoring studies of chemical residues in soil, silt, water, and biological organisms associated with the former HO storage sites at NCBC and Johnston Island.

As a research effort, the Environics Division of the USAF Environmental Sciences Laboratory (ESL) has monitored the natural degradation of HO at the former storage sites since 1980. In 1984, the Environics Division contracted with EG&G Idaho, Inc., to conduct a sampling

and analysis program. The purpose of that effort was to map dioxin concentrations and determine the horizontal and vertical extent of TCDD contamination at NCBC and Johnston Island. The results of those programs will be published in early 1986. Those two groups thus accomplished the first three goals listed above.

To accomplish the fourth goal, and to restore the former HO storage sites to beneficial use, the USAF is conducting research, testing, and evaluation demonstrations of selected decontamination technologies. As part of that research effort, the USAF began conducting pilot-scale demonstration projects in 1985 using several technologies. The object of those demonstrations is to reduce the total isomers of tetra-, penta-, and hexa-chlorodibenzo-p-dioxin and respective isomers of chlorodibenzo furan to concentrations less than 1 ppb in an environmentally safe manner. One of the proposed demonstration technologies is high-temperature incineration of soil using a mobile rotary kiln incinerator. That proposed technology is the subject of this environmental assessment.

Following completion of tests and analysis, data from all proposed technologies, including rotary kiln incineration, will be evaluated for:

1. Meeting the criteria for soil cleanup

2. Determining the efficiency, reliability, and maintainability of the technology.

3. Determining the scale-up factors for remedial action at other sites.

4. Determining the cost-effectiveness of rotary kiln incineration for use in remedial action at other sites.

C. TECHNOLOGY ASSESSMENT AND SELECTION

During the process selection, the following major approaches to manage soil containing TCDD became apparent:

a. Excavation and offsite disposal or treatment

b. Excavation and onsite storage and treatment.

The costs incurred by excavation, transportation, and disposal or treatment at EPA-permitted hazardous waste facilities presently eliminate the first approach as a near-term environmental restoration technology. Onsite treatment of TCDD in soil reduces restoration costs and eliminates transportation costs.

The primary alternatives considered for the disposal or detoxification of dioxin-contaminated soils are listed in Table 1. Table 1 also lists the processes considered and their major reasons for rejection. A more detailed discussion of the alternatives is given in Reference 1.

TABLE 1. LIST OF PROCESS ALTERNATIVES CONSIDERED

Process Name	Reason for Rejection
UV photolysis	Not rejected; pilot-scale studies have been conducted on NCBC and will be conducted on Johnston Island in mid-1986
Alkalide polyglycoxide	Uncertainty about the effect of water on the reaction; need for laboratory testing for optimization; chemical formulation data not well defined
Chemical oxidation with catalyst	Limited data base; expensive alloys needed; toxicity of catalyst; not applicable for in situ treatment of contaminated soils
Catalyzed wet oxidation	High capital expense due to high pressure process; lack of good data base
Supercritical fluids	Lack of strong data base; expensive corrosion-resistant materials needed
Organo-metals dechlorination	Soil containing moisture would result in high chemical costs
Hydrazine reduction	Very promising but only laboratory data available; no pilot-scale data available
Preliminary microbial metabolization	Lack of data base; uncertainty regarding degradation intermediates and end products and their toxicity
Microwave plasma detoxification	Conversion efficiency of only 99% achieved; general lack of strong data base
In-situ vitrification	Not rejected; is still being considered; however, the disadvantages include high energy costs, high capital costs, and lack of strong data base
Plasma arc pyrolysis	Very high PCB destruction removal efficiency but pilot test data unavailable; also regulatory acceptability and technical feasibility not clear with respect to contaminated soils

TABLE 1. LIST OF PROCESS ALTERNATIVES CONSIDERED (CONCLUDED)

Process Name	Reason for Rejection
Radio frequency detoxification	Not rejected; work scheduled for a pilot/laboratory scale program
Corona glow processing	Limited data base and process is not directly applicable for contaminated soils
Extraction with solvent	Not viable means of achieving the 99+% removal efficiency. Inherently has a low removal efficiency
Adsorption with activated carbon	Limited data; spent carbon still requires ultimate disposal; process not readily adaptable to soils
Distillation/stripping	Technology has not been demonstrated on any scale for dioxin-containing liquids. Process not readily adaptable to solids
Potassium hydroxide/ Polyethylene glycol	Not rejected; pilot studies currently being conducted

SECTION II
DESCRIPTION OF PROPOSED ACTION

A. PROJECT DESCRIPTION

The proposed action is to conduct a demonstration project at the USAF's former HO storage site at NCBC using a mobile rotary kiln incinerator. Pending the acquisition of appropriate permits and approvals, the project is currently planned to begin in mid-1986. The demonstration will be conducted for the USAF by ENSCO, White Bluff, Tennessee, under the project management of EG&G Idaho and the U.S. Air Force.

A modular incinerator, MWP-2000, will be transported to NCBC to demonstrate the destruction of dioxins in concrete stabilized soil and the reliability and maintainability of the technology. The operating incineration system consists of eight trailers of equipment, including a shredder, rotary kiln, secondary combustor, waste heat boiler, scrubber, neutralization system, control room, and laboratory.

The demonstration is planned to last approximately 6 months and will consist of equipment setup, thermal testing, operation, teardown, and site closure.

Setup and thermal testing will take approximately 6 weeks. The proposed incinerator is a mobile unit. Setup at the sites will not create excessive construction noise or fugitive dust problems because extensive foundations are not needed. Personnel working within the contaminated area will be in protective clothing to protect them from dioxin hazards (Reference 2).

Thermal testing will be conducted to verify that the MWP-2000 incinerator will destroy the dioxin in the contaminated soil, resulting in a soil concentration of less than 1 ppb. Analysis will also be performed to verify that incineration of the soil matrix does not produce additional waste that is considered hazardous by the EPA as defined in 40 CFR Part 261.

Pending analysis, a formal delisting petition will be submitted to EPA for approval. Specifically, that petition will request that ash resulting from incineration of the NCBC dioxin-contaminated soil not be considered an F028 hazardous waste, as described by Resource Conservation and Recovery Act (RCRA). General processing of the contaminated soil will then proceed, pending EPA approval of the delisting petition.

General testing includes two major steps that will occur simultaneously: soil handling and soil processing. The soil handling task includes excavation of contaminated soil, movement of that soil to the incinerator feed hopper, movement of the processed soil back to an area from which the contaminated soil came, and final grading of the soil to the original contours. Based on results of the previously mentioned contamination mapping project, "clean routes" and "contaminated routes" will be delineated at the site. Heavy earth-moving equipment will use the appropriate routes during the project to prevent the spread of contamination. The contaminated areas to be excavated for incinerator feedstock will also be determined by the final results of the soil mapping report.

Following excavation and movement of the soil to the feed hopper, the soil will be incinerated in a rotary kiln incinerator, which also has a secondary combustion chamber. The incinerator will desorb the dioxin from the soil matrix and thermally destroy it to the basic constituents of H_2O, CO_2, and HCl. The secondary combustion chamber ensures complete destruction of the dioxin.

After the soil is processed, it will be moved to a clean area near the incinerator. The soil will remain there until onsite sampling and analysis verifies decontamination to the 1 ppb level. If the soil is "clean", earth-moving equipment will move it via a "clean route" to an excavated area or another clean area to await grading and contouring. If analysis shows that the soil is not decontaminated to the required limit, it will be reprocessed to achieve the required decontamination.

B. WASTE/SOIL ANALYSIS

The soil to be burned is classified as sandy loam. The soil at the former HO storage site has been stabilized with Portland cement; that is, before its use at a storage site, the soil was plowed to a depth of 6 inches and tilled with Portland cement. This, in effect, makes the top 6 inches hard and crusty. The purpose of the stabilization effort was to provide an inexpensive, firm base on which to park vehicles, heavy equipment, bulk materials, or other large miscellaneous items.

During storage and handling of the HO, some of the contents of the barrels leaked onto the ground. Most of those spills were covered with shell material (e.g., oyster and clam shells), which acted as an absorbent. In many areas, the soil is partially covered with asphalt scraps and road oil. Most of the area has also been covered with a thin layer of pea gravel.

A soil mapping project was conducted in 1985 to determine the dioxin concentration levels. That project divided the former HO storage site into 1306 plots that measured 20 by 20 feet. A composite sample consisting of five subsamples from each plot was taken and analyzed for 2,3,7,8-TCDD. Additional samples were taken from selected plots to determine if other hazardous constituents were present in the soil. That analysis determined the concentration of TCDD to range from nondetected to 948 ppb and the constituents of HO to range from nondetected to 20,000 ppb.

Figure 1 shows the location of the former HO storage site on NCBC, and Figure 2 shows the plots that contained dioxin levels in excess of 1 ppb. Figure 2 shows the location of the selected samples that were analyzed for additional hazardous constituents. Details of the soil analysis project are presented in the delisting petition and in a formal report to be published in mid-1986 (Reference 1). Both reports will be available from EG&G Idaho, upon request.

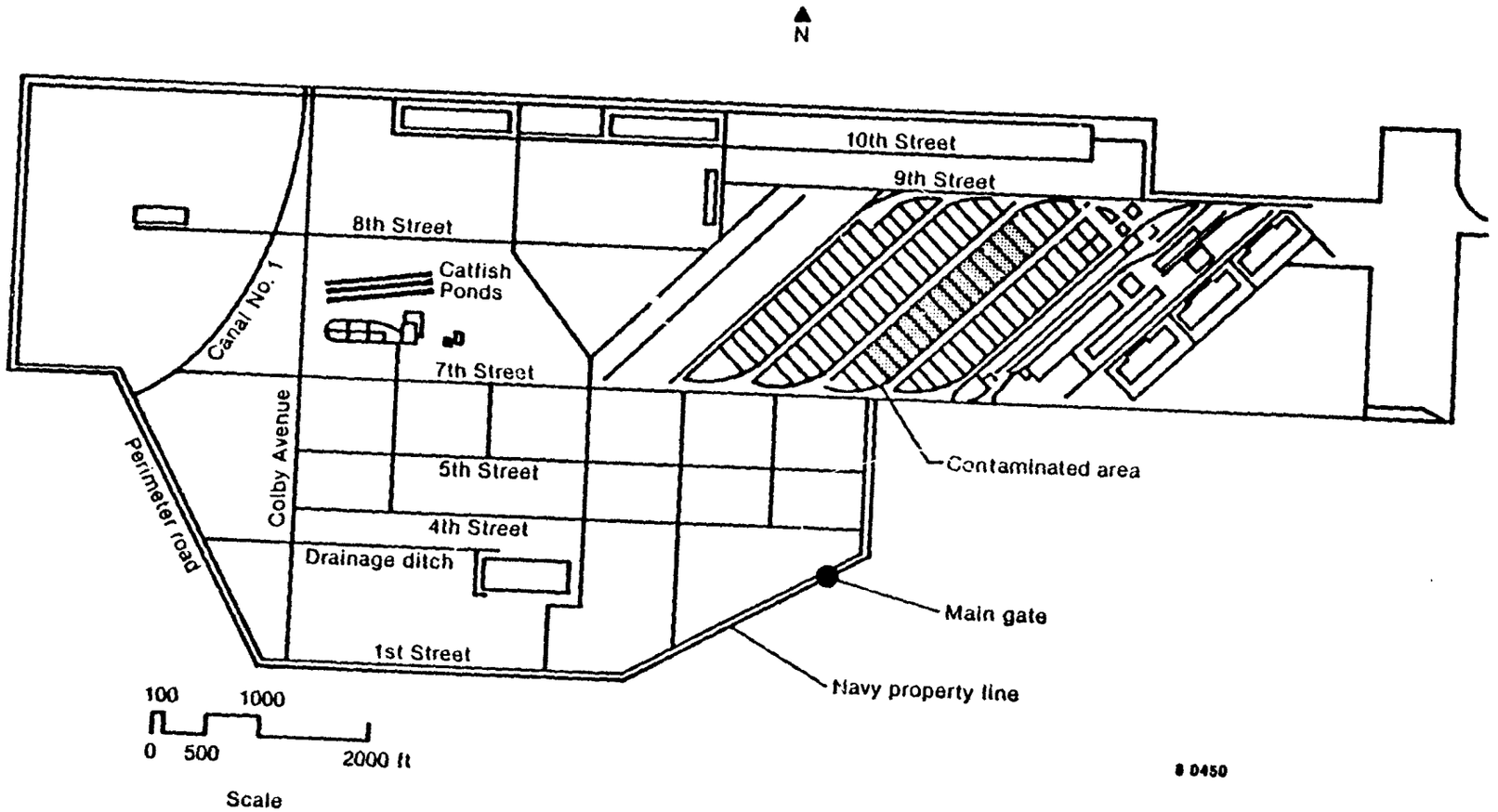

Figure 1. Street map of NCBC showing former HD storage site.

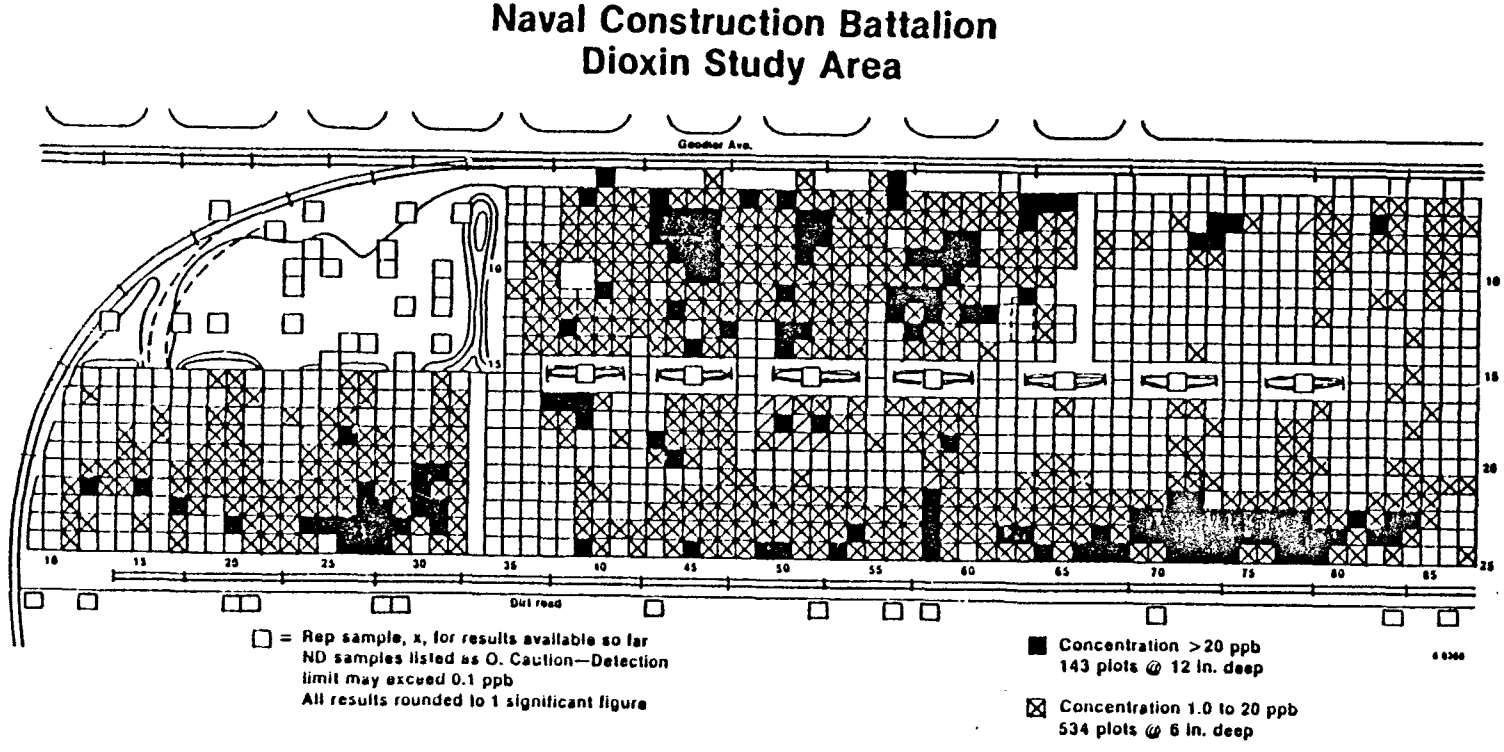

Figure 2. Former HO storage site.

Despite the dioxin contamination, asphalt, road oil, etc, the site is sparsely covered with a variety of indigenous grasses weeds, and a few small shrubs. Those plants will be processed in the incinerator as part of the soil matrix.

C. PROPOSED PROJECT PROCESS DESCRIPTION

1. General Description

The Ensco incinerator (Mobile Waste Processor--MWP-2000) is designed and fabricated by the Pyrotech Division of Ensco Environmental Services Company (Ensco) in White Bluff, Tennessee. The MWP-2000 is a modular mobile incinerator system designed to destroy solid, semisolid, and liquid waste contaminated with polychlorinated biphenyls (PCBs) and other organics. The system can also destroy waste contaminated with 2,3,7,8-TCDD. Before arrival onsite, the MWP-2000 will have undergone PCB test burns and RCRA trial burns for FO-20 through FO-28 wastes prior to arrival at NCBC. Most of the system components are installed on flatbed trailers to facilitate the movement of the system from site to site to perform onsite cleanup of contaminated soils and other wastes.

Figure 3 shows the general arrangement of the system as it will be used at NCBC. Figure 4 is a flow diagram of the system. The principal components of the system are the following:

- o Waste feed system
- o Rotary kiln incinerator
- o Secondary combustion system
- o Air pollution control system
- o Control room and laboratory.

The ancillary components of the system are the following:

- o Waste heat boiler and steam drum
- o Boiler makeup water treatment system

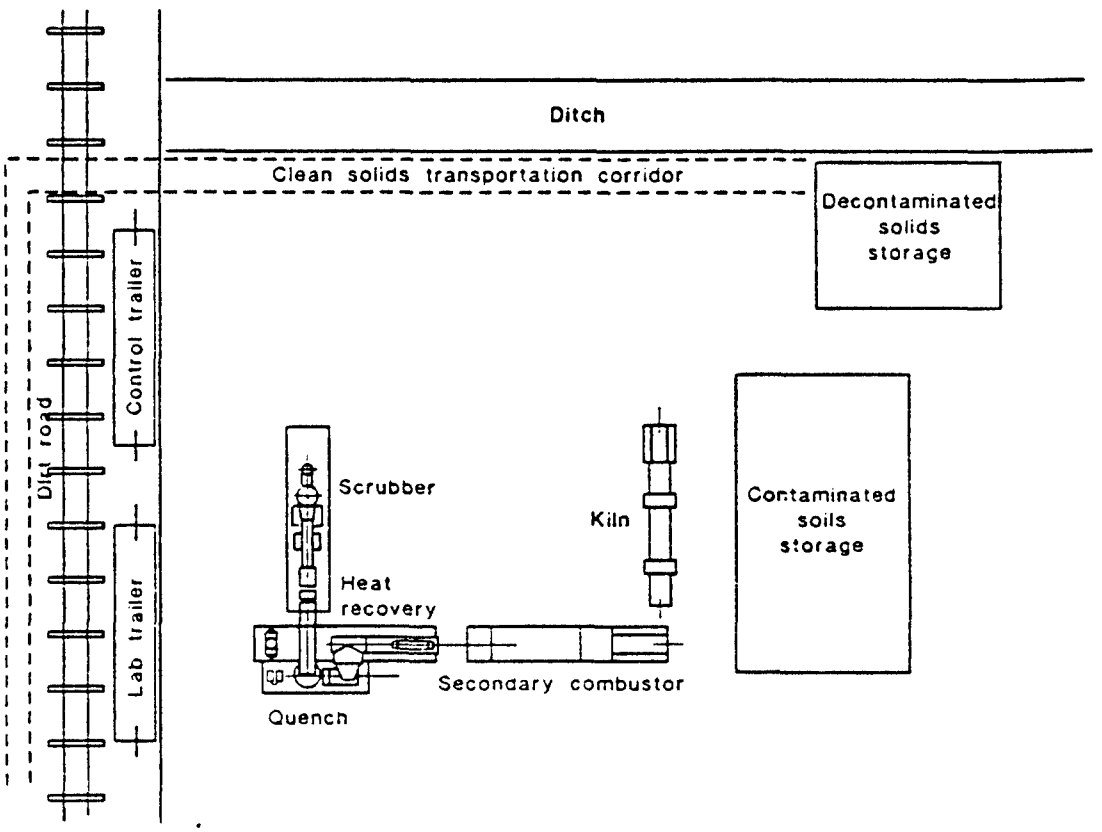

Figure 3. Proposed Gulfport MWP-2000 layout.

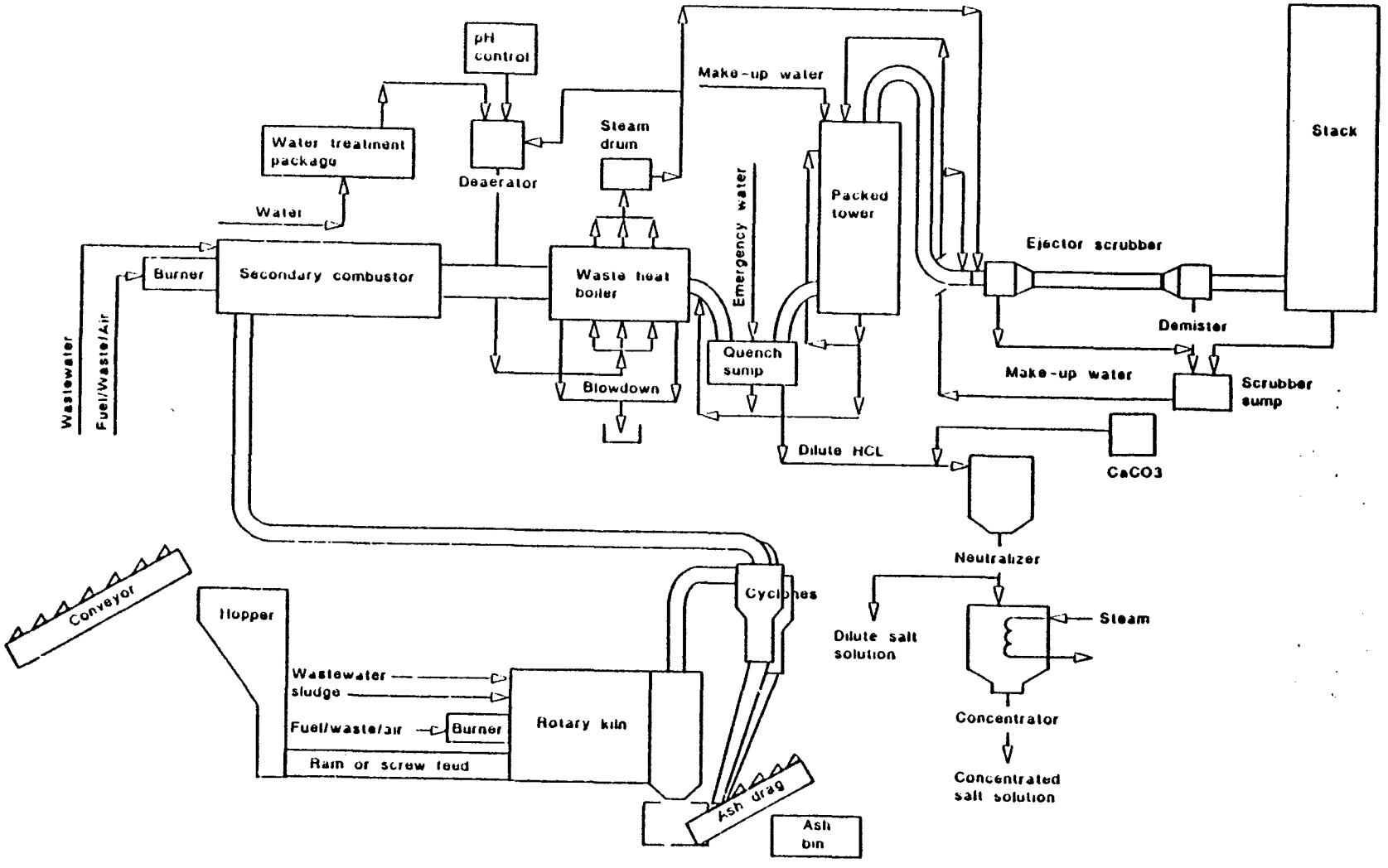

Figure 4. Schematic flow diagram of MWP-2000.

- o Ash removal system
- o Effluent neutralization and concentration system
- o Clean fuel holding tanks.

The following is a brief description of the process; a detailed description is provided in subsequent sections.

At NCBC, the contaminated soil will be fed into a weighing hopper by a front-end loader. From the weighing hopper, the soil will drop onto a conveyor belt, which in turn drops the soil into a feed hopper. From the feed hopper, the soil will be dropped into either a rotary auger conveyor or a ram feeder that will directly feed the soil into the rotary kiln incinerator. Depending on the physical characteristics of the soil, a shredding or milling device may be used to provide a more uniform size feedstock.

The rotary kiln will heat the soil to 1000-1800°F, which will either burn or gasify all combustibles including TCDD. The treated (incinerated) soil will then exit the rotary kiln and will fall into a water-sealed ash quencher. A chain-drag conveyor will then discharge the soil into a dumpster. When the soil cools, the dumpster will be moved to a clean soil storage area near the kiln (see Figure 3). The treated soil will be held for 48 hours, pending laboratory verification that delisting criteria have been met, i.e., that the dioxin/furan concentration is less than 1 ppb and that no significant quantities of other hazardous materials are present. Once verification is obtained, the soil will be returned to an area determined to be clean on the HO storage site.

Meanwhile, the off-gas from the rotary kiln is drawn into the secondary combustion chamber (SCC) where it is subjected to temperatures of 2000 to 2400°F in an excess oxygen atmosphere for a minimum of 2.2 seconds. The SCC ensures complete burning of waste gases.

Gases from the SCC then pass into the waste heat boiler to produce 250-psig steam for use downstream in the ejector scrubber. From the boiler, the gases then pass into the quench sump, which reduces the off-gas temperature for subsequent processing in the packed tower.

The packed tower removes 99 percent of the HCl gas produced during the combustion process. In the packed tower, the gases flow upward through the tower and are scrubbed by a countercurrent flow of water flowing over Tellerette^{R} shaped packing material.

From the packed tower, the off-gas is drawn into the ejector scrubber. That device, which operates on the principle of an ejection pump, not only provides the prime motive force for moving the off-gases, but also acts to scrub particulates from the off-gas. Steam generated in the waste heat boiler serves as the motive fluid. The clean off-gas then is forced up the 35-ft stack.

2. Rotary Kiln

The primary function of the rotary kiln is to burn or gasify all combustible solid waste, including contaminated soils. The kiln is a carbon steel cylinder (6 feet, 7 inches in diameter, 30 feet long) mounted horizontally on a flatbed trailer. The first third of the kiln, which is the flame zone, is lined with insulating brick and fire brick. The remaining length of the kiln is lined with fire brick.

A short refractory dam is located at the downstream end of the kiln and at several locations within the kiln. The purpose of those dams is to increase the residence time of the waste in the kiln.

The residence time of the waste is also a function of the kiln's rotation speed. An electrically driven, hydraulically controlled motor controls the kiln rotation between 1.5 to 4 rpm.

The kiln is supported by bearing rollers, which are mounted to one of the flatbed trailers. The kiln is mounted so that its inclination may be varied, thus providing another variable for waste residence time.

By varying the rotation speed, the number and location of the refractory dams, and the angle of the kiln, the residence time of the waste in the kiln can be varied from 30 to 60 min.

Inside the kiln, the soil will be subjected to temperatures of 1000 to 1800°F, which will cause all combustibles to be either burned or gasified. The temperature of the rotary kiln is sufficient to desorb the dioxin from the soil matrix, thus driving the dioxin into the off-gas. The resulting gases will pass from the incinerator to the SCC, while the incinerated waste will remain in the kiln for at least 30 minutes to ensure destruction and removal of dioxin to at least the delisting criteria limit.

Kiln temperature, which is measured with a thermocouple at the kiln exit, is controlled by adjusting the natural gas flow, combustion air, and waste input.

The kiln is equipped with a single natural-gas-fired burner that can produce 14 MBtu/hr. The burner has a propane pilot light and an ultraviolet flame detector.

Ash formed in the rotary kiln is discharged into a bellows-sealed breaching at the lower end of the kiln. Ash falls from this breaching into an ash receiving tank, which is filled with water to a height above the discharge lip of the breaching to provide a water seal. A chain dray conveyor removes the ash from the ash receiving tank and transfers it into portable bins, which are used to transport the ash to the clean soil storage area.

3. Secondary Combustion Chamber

The purpose of the secondary combustion chamber (SCC) or combustor is to completely burn the waste off-gas containing TCDD. The SCC is a carbon steel cylinder mounted horizontally on two supports on a flatbed trailer. It is lined with both insulating brick and fire brick. The resulting interior dimensions provide an effective volume of 1400 ft^3.

Gases from the kiln arrive in the SCC via a carbon steel duct lined with castable refractory material. This duct introduces gases into the SCC tangentially through a rectangular port on the upper right side of the inlet end of the combustor. The duct is also equipped with an expansion joint that allows for thermal expansion and eases alignment during equipment setup.

By using a 24-MBtu/hr natural-gas-fired vortex burner, the off-gases are heated to 2000 to 2400°F for 2.2 seconds in the presence of excess oxygen. The burner is designed to produce a short, highly turbulent flame cone. To further ensure combustion turbulence, combustion air is introduced tangentially by a high-volume blower.

Because of the SCC residence time and temperature, 99.9999 percent of the TCDD in the off-gas will be oxidized to the simple combustion products of H_2O, CO_2, and HCl.

The gases exit the SCC through a carbon steel refractory-lined duct. Although not shown in Figure 4, this duct will be equipped with an emergency vent that can be opened to vent gases away from the boiler if a loss of coolant water occurs in the steam drum.

4. Waste Heat Boiler

After gases exit the SCC, they enter the waste heat boiler. The purpose of the waste heat boiler is to produce steam that is subsequently

used as the motive fluid in the ejector scrubber downstream. The boiler's heat transfer capacity causes the off-gas temperature to reduce from 2200 to approximately 390°F.

5. Off-Gas Treatment System

The air pollution control train consists of a quench system, a packed tower, an ejector scrubber, and a stack. This equipment train is designed to cool the gases, remove approximately 1500 lb/hr of HCl, and remove particulates in sizes greater than 0.3 μm. The quench system and packed tower are installed on the same flatbed trailer that holds the waste heat boiler. The ejector scrubber and stack are installed on a separate trailer.

a. Quench System

This system consists of a quench sump and a vertical 90-deg quench elbow, which conveys exit gases from the waste heat boiler to the sump. The quench elbow is fabricated of Inconel to resist the corrosive effects of the acid gases in the system. The quench elbow contains several nozzles that spray a fine mist of recirculated water into the elbow to cool the gases from approximately 600 to 150°F. The mist interacts with the HCl in the off-gas. The HCl gas is absorbed into the water droplets, which then fall to the bottom of the quench sump or are carried over to the packed tower. If necessary, $CaCO_3$ (lime) can be added to the quench tank to help neutralize the acid gas.

The quench sump serves as a collection sump for excess recirculation water from the air pollution control train and also provides additional residence time for cooling gases passing through the quench system. The quench sump is fabricated of fiberglass-reinforced plastic. The outlet duct that conveys gases to the packed tower is also fabricated of fiberglass-reinforced plastic.

The quench system is served by a pair of pumps (one of which is a standby pump) that recirculates water from the quench sump to the spray nozzles in the quench elbow. An in-line solids separator between the pumps and the spray nozzles removes particulates that could otherwise plug the nozzles. The quench sump is served by a raw water line that enables the adding of emergency makeup water to the sump in case of an emergency low-water condition.

b. Packed Tower

The packed tower removes HCl from the off-gas. The packed tower can remove 99 percent of the HCl leaving the quench sump, assuming a maximum loading of 1600 lb/hr. The gases flow upward through the tower and are scrubbed by a countercurrent flow of water that is recirculated from the packed tower sump and from the ejector scrubber sump. The packed tower can also add makeup water to the system. Excess recirculation water is pumped to the quench elbow.

The packed tower is a fiberglass-reinforced plastic tank. It is packed to a depth approximately half its length with plastic shapes called Tellerettes^{R}. A demister pad lies above the packing material.

Recirculation water flows from the packed tower sump and ejector scrubber sump. Makeup water flows are measured by turbine type flowmeters that transmit signals to digital readouts on the control panel.

c. Ejector Scrubber

The ejector scrubber is designed to remove additional particulate and HCl from the gases before they are discharged through the stack. The scrubber can remove 99 percent of incoming particulates in sizes greater than 0.3 μm and 99 percent of the incoming HCl. Gases exiting the packed tower are drawn through the ejector mixing tube by the force of steam delivered through a nozzle in the mixing tube. The waste

heat boiler provides steam for the mixing tube. The turbulence created by the unique nozzle in the mixing tube causes the agglomeration of submicron particulates and HCl in the water vapor supplied by the steam. This agglomerated material is removed by the demister, which is integrated into the scrubber.

The ejector scrubber also acts as an ejector pump that serves as the prime mover for the entire system. The structural components of the ejector scrubber are fiberglass-reinforced plastic.

Condensed water removed by the demister and drainage from the ejector scrubber drain into the ejector scrubber sump. A recirculation pump recirculates this water to the ejector scrubber and to the packed tower. The recirculation water passes through a solids separator to remove suspended solids. Capability is also provided to add makeup water to the ejector scrubber sump.

d. Exhaust Stack

The exhaust stack is made of fiberglass-reinforced plastic. Three sections form a stack 35 feet, 6 inches high. Condensate formed in the stack drains to the ejector sump.

6. Process Monitoring

The MWP-2000 includes a fully integrated data acquisition system. That system obtains data from thermocouples, pressure transducers, flame detectors, and other instruments and either displays the information on a control panel in the control room or enters the data to a computer or both. Much of the data entered into the computer is used to operate the automatic waste feed shutoff control system. That system will automatically switch feed to the burner from waste to fuel and to simultaneously and automatically cut off wastewater flow to the wastewater injection nozzles and solid waste feed through the ram feed when any of the following conditions occurs:

a. Combustion efficiency, as measured by $100 \times O_2/(CO_2 + CO)$, falls below 99, where O, CO, and CO_2, respectively, are the oxygen, carbon monoxide, and carbon dioxide concentrations in the stack gases.

b. Oxygen concentration in the stack gases falls below 3%.

c. Secondary combustor outlet gas temperature falls below 2150°F.

These same conditions cause a simultaneous automatic wastefeed switching or waste cutoff to the secondary combustor.

Stack gas analyzers in the control room and laboratory trailer continuously supply measurements of the concentrations of oxygen, carbon monoxide, carbon dioxide, and oxides of nitrogen in the stack gases. Those measurements, with the exception of the NO_x measurement, are transmitted to the data acquisition and control computer, which uses them to monitor conditions a and b above, and effect automatic waste feed switching and shutoff. The thermocouple in the combustor outlet duct provides the computer with data to monitor condition c and effect automatic wastefeed switching and cutoff procedures.

A flame supervisor serving the kiln shuts off all fuel and waste flow to the kiln burner when there is a loss of flame in the kiln.

A flame supervisor serving the secondary combustor switches feed to the kiln burner from waste to fuel and cuts off all other waste feeds to the kiln when there is a loss of flame in the combustor. Simultaneously, this supervisor shuts off all fuel and waste feeds to the combustor.

A low-low liquid level switch on the steam drum shuts off all fuel and waste feeds to the kiln and secondary combustor when the water level in the drum falls below 25 percent.

a. Control Room and Laboratory

The control room and laboratory (Figure 3) are located in two trailers that will be parked between the scrubber and kiln trailers. The control room trailer contains all indicator readouts, controllers, control switches, and the data acquisition and control computer used to operate the MWP-2000. Most of this instrumentation is installed on a control panel. The control room also houses the stack gas analyzers discussed earlier.

The laboratory trailer is fully equipped to enable chemical and heating value analyses of wastes to be burned and chemical analyses of the residues (ash and effluent wastewaters) generated by the system. The two major analytical instruments in the laboratory are a gas chromatograph equipped with both flame ionization and electron capture detectors, and an atomic absorption spectrophotometer equipped with hydride and mercury vapor systems. Additional equipment in the laboratory includes an adiabatic bomb calorimeter, an oven, a furnace, a fume hood, an analytical balance, a pH meter, stirring and heating apparatus, and general laboratory glassware and chemicals.

SECTION III
DESCRIPTION OF EXISTING ENVIRONMENT[a]

A. LOCATION

As shown in Figure 5, NCBC is situated within Gulfport, with the City of Long Beach abutting its western property line. Biloxi, the county's largest city, lies approximately seven miles to the east. The town of Pass Christian is seven miles to the west.

Gulfport has a municipal airport used for daily commercial jet flights and as a National Guard Training Center. It also has the only State-owned port used by numerous ocean freighters. Ships with drafts in excess of 30 feet can use the port (Reference 4).

The lands immediately surrounding NCBC are predominantly residential. Some wooded areas to the northwest consist of open pine forest and deciduous hardwoods associated with a natural drainage, Turkey Creek. Low-density housing and areas utilized for silviculture are scattered throughout. Mississippi Sound lies approximately 1.1 miles to the south of the property.

Similar to other coastal areas, the highest population density and development occur near the coastline. Approximately 68 percent of Harrison County's population occurs along the coastal area between the Mississippi Sound and Interstate Highway 10, 4.5 miles to the north (Reference 5). The cities of Gulfport, Biloxi, Long Beach, and Pass Christian lie within this coastal zone.

B. HISTORY OF NCBC

NCBC Gulfport, which was established on June 2, 1942, was originally called Camp Hollyday. The Gulfport area was chosen for establishment of

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a. Most of the information contained within this section was obtained from Reference 3.

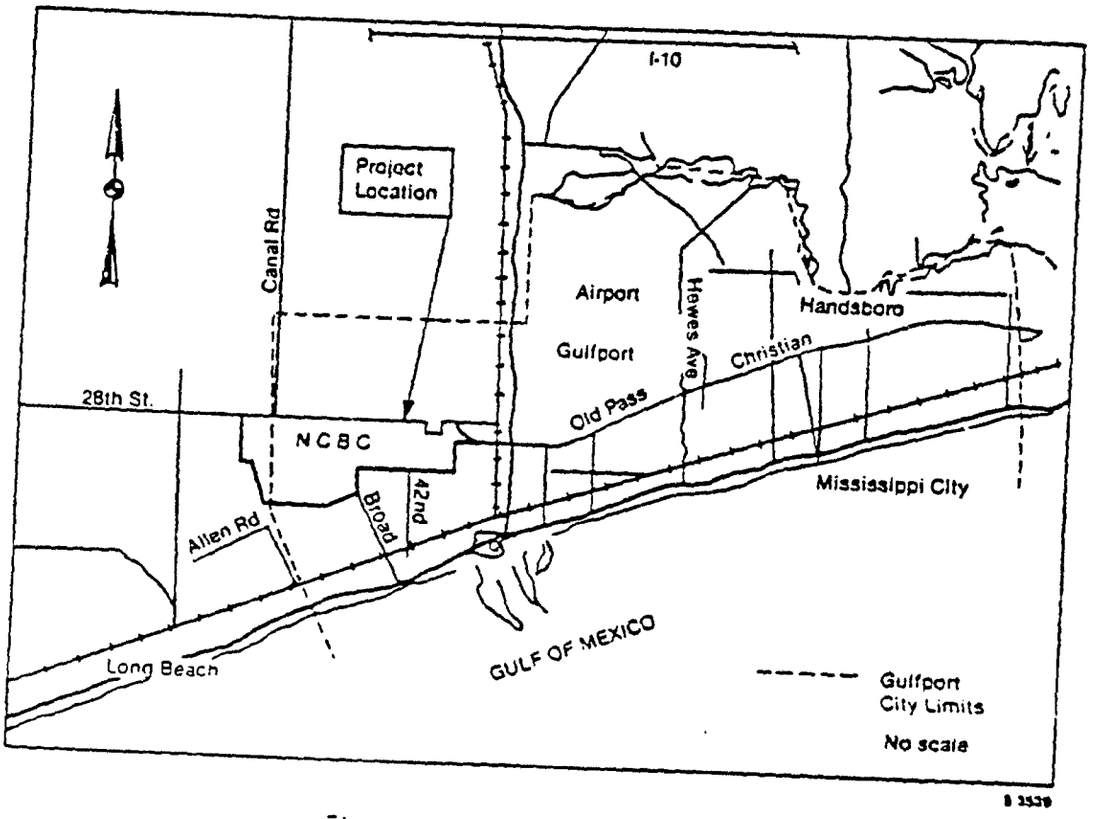


Figure 5. Location of NCBC.

the camp because of its uncongested deep-water port, which the Navy needed to serve the Caribbean area. The moderate semitropical climate of the area also allowed outloading and training of personnel on a year-round basis.

Initially, the facility was established as an Advanced Base Depot. An Armed Guard School and Cooks and Bakers School were added in November 1942. During this time, millions of tons of supplies and equipment were stored at the camp and shipped to all areas for military operations. In 1944, the mission changed from a receiving facility to a United States Naval Training Center. Continuing realignments of the center created a single command of the Naval Training Center and the Advanced Base Depot.

Temporary facilities for each of the battalions were provided in units consisting of barracks, headquarters, a mess, and storage. Reportedly, at times during World War II, as many as 25,000 Naval personnel were stationed at the center, living in wooden barracks, tents, and quonset huts. In 1945, the depot became the United States Naval Storehouse, and in 1946 the training center was decommissioned. Later, other organizational changes were made; and in July 1953, the Naval Construction Battalion Center Gulfport was established by absorbing two other naval organizations. On-board base population decreased from the early 1950s to 1966.

Commitments for construction forces in Southeast Asia led the way to an increased mission in 1966, and the center expanded to include homebase battalion support functions. After 20 inactive years, NCBC Gulfport was forming, staging, training, and homeporting two mobile construction battalions. Presently, five construction battalions, under the command of the 20th NCR, are based at Gulfport. These five "Seabee" battalions, which average approximately 750 personnel each, are deployed on a rotational schedule.

Hurricane Camille had a devastating effect on the installation in August 1969, and since that time many new buildings have been constructed. New structures are of permanent masonry construction rather than of wood. In July 1974, the Naval Construction Training Center, now the largest tenant, was established at NCBC.

C. LEGAL ACTIONS

There are no reported legal actions concerning contamination incidents at NCBC Gulfport.

D. GEOLOGY

The gulf coastal area has been slowly subsiding for millions of years, forming a trough known as the Gulf Coast geosyncline. As the trough sunk, streams emptying into the Gulf of Mexico have kept the trough nearly full by depositing huge quantities of sand, gravel, and mud. These sand and gravel deposits make up the principal aquifers in the Gulfport area. Limestones, sandstones, and shales are also present at great depths below Gulfport (Reference 6).

Beds of Miocene Age are about 3500 feet deep near Gulfport. They include the Pascagoula Formation, the Hattiesburg Formation, and the Catahoula Sandstone (Table 3). The beds have been collectively called the Miocene aquifer system. The Bucatunna Clay Member of the Byram Formation underlies the Miocene beds (Reference 7).

Above the Miocene rocks are beds of the Pliocene Series, which include the Citronelle Formation and Graham Ferry Formation.

Water-bearing beds of the Miocene and Pliocene Series are composed chiefly of clean quartz sand, are tan to light gray, and range in grain size from very fine to very coarse. Both the bed thickness and the grain

size vary considerably within short distances, typical effects of deltaic and estuarine deposition. Many beds are more than 100 feet thick (Reference 8).

The strike of the beds is east-southeast. The dip of the base of the Miocene rocks is south-southwest at about 90 feet per mile near Gulfport. The dip of the sediments above an elevation of 1000 feet below sea level on the coast probably is about 30 feet per mile (Reference 8). The dip of the beds probably is less in the shallow zone because of normal seaward thickening of the section.

At Gulfport, the top 40 to 200 feet of sediment are composed of alluvial and terrace deposits, beach deposits, and the Citronelle Formation. Some authors place the Citronelle Formation in the Pliocene and others place it in the Pleistocene.

E. HYDROLOGY

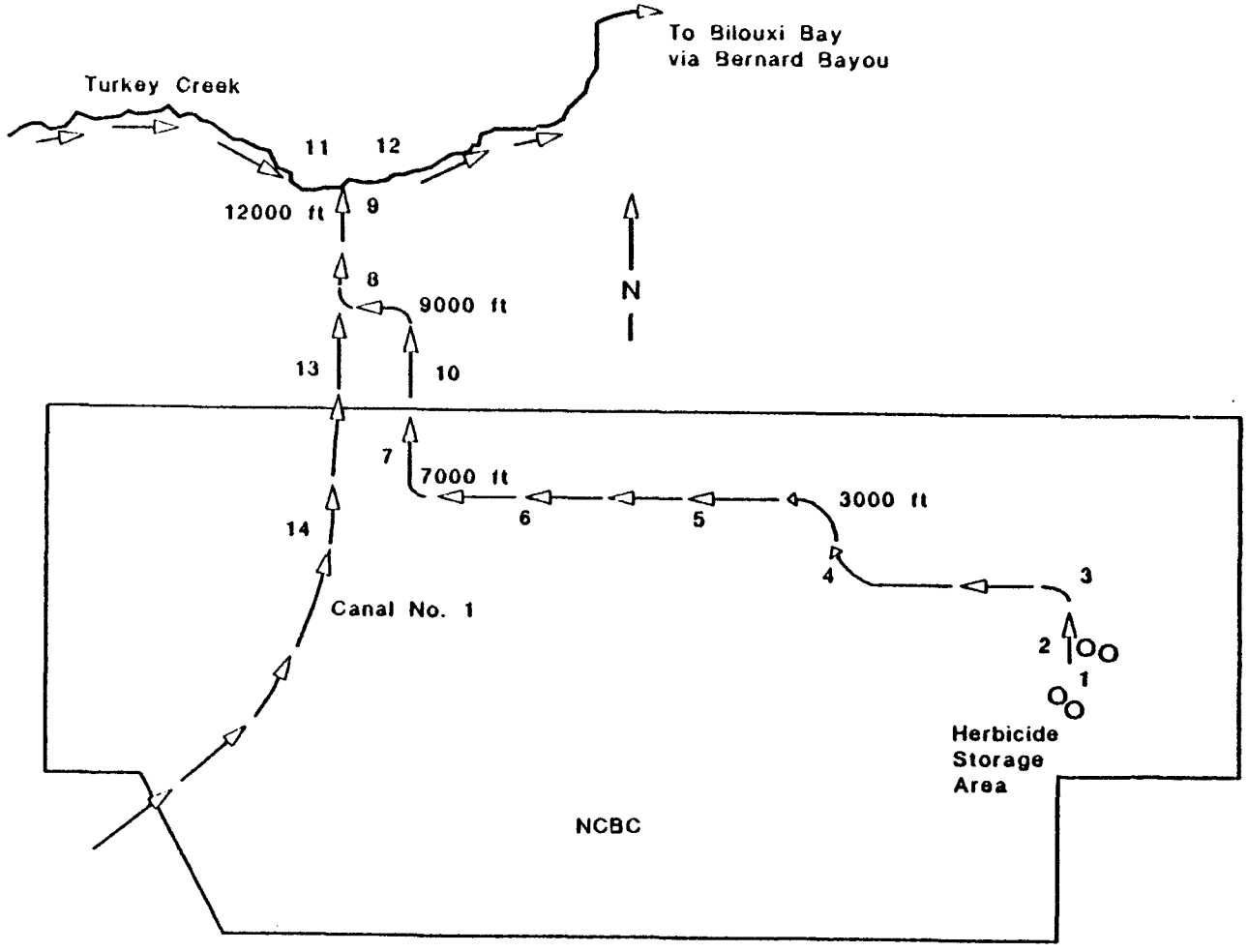
1. Surface Water

Surface runoff at NCBC is conveyed off-base by a system of drainage ditches and storm sewers. Figure 6 shows the general drainage patterns at NCBC. The entire base, with an average elevation of about 23 feet above sea level, is above the 100 year flood elevation.

The majority of NCBC land drains into Canal Number 1, which is the major onsite drainage conveyance channel at NCBC. On Navy property, this canal drains north to Turkey Creek, which discharges eastward in succession to Bernard Bayou, Big Lake, the Back Bay of Biloxi, and ultimately to the Mississippi Sound and the Gulf of Mexico. Outside Navy property and southwest of NCBC, Canal Number 1 flows west to Johnson Bayou and St. Louis Bay. The eastern port of NCBC drains to Brickyard Bayou, which drains east to Bernard Bayou, with ultimate discharge to the

TABLE 2. GEOLOGIC UNITS AND MAJOR AQUIFERS IN MISSISSIPPI (REFERENCE 7).

Erathem	System	Series	Group	Geologic unit	Major aquifer
Cenozoic	Quaternary	Holocene and Pleistocene		Undifferentiated alluvium and terrace deposits Mississippi River valley alluvial aquifer	Mississippi River valley alluvial aquifer
		Pleistocene		Loess Terrace deposits, undifferentiated	
		Pliocene		Citronelle Formation Graham Ferry Formation	Citronelle aquifers
		Miocene		Pascagoula Formation Hattiesburg Formation Catahoula Sandstone	Miocene aquifer system
		Oligocene	Vicksburg Group	Byram Formation Bucatunna Clay Member Marianna Limestone Glendon Limestone Member Marianna Limestone Mint Spring Marl Member Forest Hill Sand	Oligocene aquifer system
		Eocene	Jackson Group	Yazoo Clay Moodys Branch Formation	
			Claiborne Group	Cockfield Formation Cook Mountain Formation Sparta Sand Ziloha Clay Winona Sand Tallahatta Formation Nesnoba Sand Member Basic City Shale Member Meridian Sand Member	Cockfield aquifer Sparta aquifer system Winona-Tallahatta aquifer Meridian-upper Wilcox aquifer
				Hatchetigbee Formation	
		Paleocene	Wilcox Group	Tuscahoma Formation Nanafalia Formation Pearl Springs Member	Lower Wilcox aquifer
			Midway Group	Naheola Formation Porters Creek Clay Matthews Landing Marl Member Clayton Formation	
Mesozoic	Cretaceous	Upper Cretaceous	Selma Group	Prairie Bluff Chalk and Owl Creek Formation Ripley Formation Demopolis Chalk Coffee Sand Mooreville Chalk Arcola Limestone Member	Ripley aquifer Coffee Sand aquifer
				Eutaw Formation Tombigbee Sand Member McShan Formation	Eutaw-McShan aquifer
			Tuscaloosa Group	Gordo Formation Coker Formation	Gordo aquifer Coker aquifer Tuscaloosa aquifer system
		Lower Cretaceous		Undifferentiated	
Paleozoic	Pennsylvania Mississippian Devonian			Undifferentiated	Paleozoic aquifer system



Footages indicate distance downstream of herbicide storage area.

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Figure 6. Surface drainage patterns of NCBC.

Gulf of Mexico, as previously described. Certain areas in the southern portion of NCBC drain south into the City of Gulfport storm sewer system, with ultimate discharge to the Mississippi Sound and the Gulf of Mexico.

Biloxi Bay is classified as a shellfish harvesting area, while the Mississippi Sound is classified as a recreational area (Reference 9). These classifications represent the two highest uses of surface waters, since these activities represent an important segment of the Coast's economy. The remaining receiving waters that accept surface drainage from NCBC are classified as a fish and wildlife area (Reference 9).

Water quality problems identified in Brickyard Bayou and Turkey Creek include depressed dissolved oxygen concentrations, bacterial contamination, and high nitrogen and phosphorus concentrations. These problems have been attributed primarily to inadequately treated sewage discharges, such as septic tank drainage, and urban runoff (Reference 10).

The water quality in Bernard Bayou has been severely degraded as evidenced by high temperatures, high biological oxygen demand (BOD) concentrations, erratic dissolved oxygen concentrations, excessive nitrogen and phosphorus concentrations, high coliform concentrations, and sediment samples containing significant concentrations of volatile solids and heavy metals. The degradation of Bernard Bayou has been attributed to discharges of inadequately treated municipal, industrial, and private wastewater, urban runoff, garbage and trash dumps along the banks of the stream, and poor aeration (Reference 10).

High fecal coliform densities have been a problem in the Mississippi Sound. This problem has been attributed to inadequate municipal and private sewage treatment plants, extensive unsewered areas, and urban runoff (Reference 10).

At NCBC, four ponds, making up a total area of 10 acres, are managed as a recreational fish resource. Three 1-acre reclaimed sewage ponds, with an average depth of 3 feet, are stocked with channel catfish. A 7 acre pond, located at the golf course and approximately 5 feet deep, is managed for largemouth bass, bluegill, redear sunfish, and channel catfish. The golf course pond is also used for irrigation of the golf course.

2. Groundwater

Because of difficulties in identifying and tracing the various geologic divisions into the subsurface for geohydrologic purposes, the groundwater in southern Mississippi has been divided into two major systems. The shallowest system is the Citronelle Formation, followed by the Miocene aquifer system, which consists of the Pliocene Graham Ferry Formation and the Miocene sequence of the Pascagoula Formation, Hattiesburg Formation, and the Catahoula Sandstone. These two aquifer systems are vaguely defined, and it is not always clear whether water-bearing formations in a given area belong to the Citronelle or Miocene aquifer systems. As a general guide to the groundwater in the Gulfport area, the surficial aquifer can be considered to consist of younger deposits that overlay the Citronelle Formation. The first underlying artesian aquifer is part of the Citronelle Formation, and deeper underlying aquifers are part of the Miocene aquifer system (Reference 11).

Three well logs at NCBC (NCBC Public Works Drawing No. 10-51) indicate that the surficial aquifer at NCBC consists of sands and sand and gravel ranging from 13 to 45 feet in thickness, which are underlain by a layer of clay ranging in thickness from 28 to 197 feet. These surficial sands represent younger deposits that overlie the Citronelle Formation along the Mississippi Coast and possibly the upper portions of the Citronelle Formation.

At NCBC, localized groundwater flow in the surficial aquifer is from topographic highs to areas of discharge such as nearby drainage ditches or canals. The regional groundwater gradient is southward to the Mississippi Sound.

There are no published detailed investigations or mappings of the surficial aquifer in the Gulfport area. Currently, the United States Geological Survey Office in Jackson, Mississippi, is conducting a surficial groundwater study that covers the northern part of Gulfport as the southern limit of the study. However, no reports have been published yet (Reference 11).

The Citronelle Formation is composed mostly of quartz sand, chert gravel, and lenses and layers of clay, in proportions that vary from place to place, as described previously (Reference 12). The Citronelle deposits generally cover the surface of southern Mississippi (Reference 13). The formation, which is highly dissected by streams in its area of outcrop, makes up many discontinuous and hydrologically independent water-bearing units or aquifers (Reference 12). The formation varies from 80 to 100 feet in thickness, unless the unit is missing due to erosion. The slope of the Citronelle deposits is generally toward the south at 6 to 25 feet per mile (Reference 13). At Gulfport, the Citronelle is covered by younger deposits, and the base of the formation is about 100 feet below the 1929 NGVD (Reference 12).

The Citronelle Formation is very permeable and readily receives and transmits water from precipitation. Water infiltrates to the water table and then either moves laterally to valley walls to be discharged by springs and seeps or continues downward into underlying Miocene aquifers. Where the underlying units are permeable sand, a large part of the water may continue downward; and where underlying clays predominate, most of the water moves laterally to discharge points. The Citronelle Formation functions as a principal source of the water that sustains the low flow of many streams. Because of this drainage effect, only a part of the permeable sand and gravel in the Citronelle is saturated. The saturated

zone thickens southward as the unit thickens. In the extreme southern part of Mississippi, many sand beds are completely saturated and, in some places, confined (Reference 12). Well logs at NCBC indicate that the Citronelle aquifer is probably confined within the area of the base. Free flowing conditions have been encountered during well drilling at NCBC, as described previously. Water levels in the Citronelle aquifers change seasonably. The highest levels occur in the spring as a result of the rains and from reduced evapotranspiration during the winter and early spring (Reference 12).

The hydraulic gradient in the Citronelle aquifer, in areas where it is unconfined, can be roughly approximated by assuming that it corresponds to the slope of the deposits, which varies from 6 to 25 feet per mile. The Citronelle aquifer has an average hydraulic conductivity of about 150 feet per day (Reference 14). Applying Darcy's law and assuming a hydraulic gradient of 6 to 25 feet per mile, the rate of regional groundwater flow in the Citronelle aquifer ranges from about 60 to 260 feet per year toward the south.

Water from the Citronelle aquifer is generally good for most purposes. The water typically has a low pH and is soft to moderately hard; and the mineral content is low (Reference 14). The water has dissolved solids of less than 1,000 milligrams per liter (mg/L), except in small areas along the Gulf Coast where saltwater has intruded from estuarine streams or from the Mississippi Sound (Reference 12).

The Citronelle Formation is the shallowest significant source of groundwater in much of southern Mississippi. A large number of domestic wells and a few municipal wells are completed in the Citronelle aquifer in southern Mississippi (Reference 13). In the coastal lowlands, wells are drilled several hundred feet below the Citronelle aquifer for the large natural flows that can be obtained from the Miocene aquifers (Reference 12). This is the case at NCBC where all water supply wells tap the Miocene aquifer system, as described previously.

The Miocene sequence in southern Mississippi has been subdivided by some workers into the Pascagoula Formation, Hattiesburg Formation, and Catahoula Sandstone from youngest to oldest, but these divisions cannot be reliably identified or traced in the subsurface. Likewise, a unit at the top in the coastal counties has been identified as Pliocene in age on the basis of fossil evidence and assigned the name Graham Ferry Formation. Again, the unit cannot be distinguished from the next lower formation by lithological, geophysical, or hydrological means. Consequently, all material between the Citronelle Formation, a blanket deposit of Pliocene age, and the base of the Catahoula Sandstone is considered to compose the Miocene aquifer system (Reference 14).

The Miocene aquifers in the coastal counties consist of thick beds of sand of gravel separated by clay layers (Reference 13). These water-bearing sands, or aquifers, occur irregularly through the Miocene sequence and are composed chiefly of clear quartz sand and tan or light gray. There are no thick consistently traceable clay beds (Reference 8).

Because of the lenticularity of the sand beds, the sand intervals do not extend very far laterally (Reference 14). Both the bed thickness and the grain size vary considerably within short distances, which is a characteristic effect of deltaic and estuarine deposition. Many beds are more than 100 feet thick (Reference 8). At any site, multiple aquifers or zones of sand are likely to occur, and many of these are hydraulically connected (Reference 14). The number of major aquifers underlying the coast has not yet been established, but water bearing units probably underlie most of the coastal area (Reference 15). Electric logs of oil tests at 11 sites in Harrison County indicate the presence of up to 11 freshwater sand intervals at a given site (Reference 8). At NCBC, well logs of three of the water supply wells (Wells L160, L161 and L162) indicate the presence of six to seven beds of sand in the upper part of the Miocene aquifer system, which differ in elevation and thickness among the three sites (Reference 3).

The Miocene aquifers are recharged by rainfall directly on the outcrops to the north of the coastal area, by infiltration from overlying surficial deposits (Citronelle Formation and younger sediments), and by interaquifer movement through the clay and silt beds that separate sand units. In Harrison County, the sand beds or lenses are sufficiently interconnected hydraulically to permit interflow but not to create a pressure common to all the aquifers (Reference 8). Water levels in the Miocene aquifer system are declining regionally at a rate of 1 to 2 feet per year. Near centers of heavy pumping, the annual decline is much greater (Reference 14). In the Gulfport area, current water levels in the 600-900 feet zone of the Miocene aquifer system range from approximately 40 to 50 feet below ground (Reference 16). At NCBC, the static water levels in the water supply wells L160, L161, and L162 (Reference 3), when first installed in 1942, were from 14 to 15 feet above ground. The water level in Well L160 was measured in November 1965 at 1 foot above the land surface (Reference 8). Well A, another water supply well installed in 1978, had a static level of minus 39 feet below ground.

Water movement is gulfward, in the direction of the regional formation dip towards areas of artificial discharge (pumping) or natural discharge (upward leakage or to the sea). The potentiometric surface slopes at a low rate, probably less than 5 feet per mile (ft/mile) except near pumping centers (Reference 14). Pumping tests in the Gulfport area indicate that hydraulic conductivities in the Miocene aquifers range from about 195 to 1,200 gallons per day per square foot (Reference 8). Applying Darcy's law and assuming a hydraulic gradient of 5 ft/mile, the rate of groundwater flow ranges from about 9 to 56 ft/year.

Freshwater is available from the Miocene aquifers wherever the system occurs. However, in much of southern Mississippi, the lower part of the Miocene series contains saline water (Reference 14). In the Gulfport area, the base of the fresh groundwater is approximately 2,500 feet below sea level.

The quality of the water in the Miocene aquifers is generally good. The only significant problem is excessive iron in places. In many, if not most, of the high-iron situations, the acidic nature of the water is probably responsible for corrosion of iron fittings and the consequent inclusion of the occurrence of acidic water. The water is almost exclusively a soft, sodium bicarbonate type and is markedly uniform aerially and stratigraphically (Reference 14).

Because of its thickness, aerial extent, and permeability, the Miocene aquifer system is the largest potential source of groundwater supplies in Mississippi. The Miocene aquifer system is currently tapped for slightly more than one-fourth of the groundwater withdrawn in Mississippi for uses other than irrigation (Reference 14). All water supply wells at NCBC tap the Miocene aquifer system, as described below.

3. Water Supply

All water utilized at NCBC is obtained from onsite wells. Figure 7 indicates the locations of the various wells.

The NCBC potable water supply system consists of five wells (Wells L160, L161, L162, A and B) that tap the Miocene aquifer system and two 500,000 gallon storage tanks. The five wells range in depth from 722 to 1,196 feet and have a combined capacity of approximately 3,600 gallons per minute (gpm). Water from the wells is used for potable, industrial, fire fighting, and recreational purposes. The only treatment consists of chlorination. The City of Gulfport's municipal water system provides a backup water supply to NCBC Gulfport.

In addition to the potable water supply wells, a 300 foot deep Miocene aquifer well (Well 1) is used for process water by the asphalt plant. Another well (Well 2) located at the golf course has been used

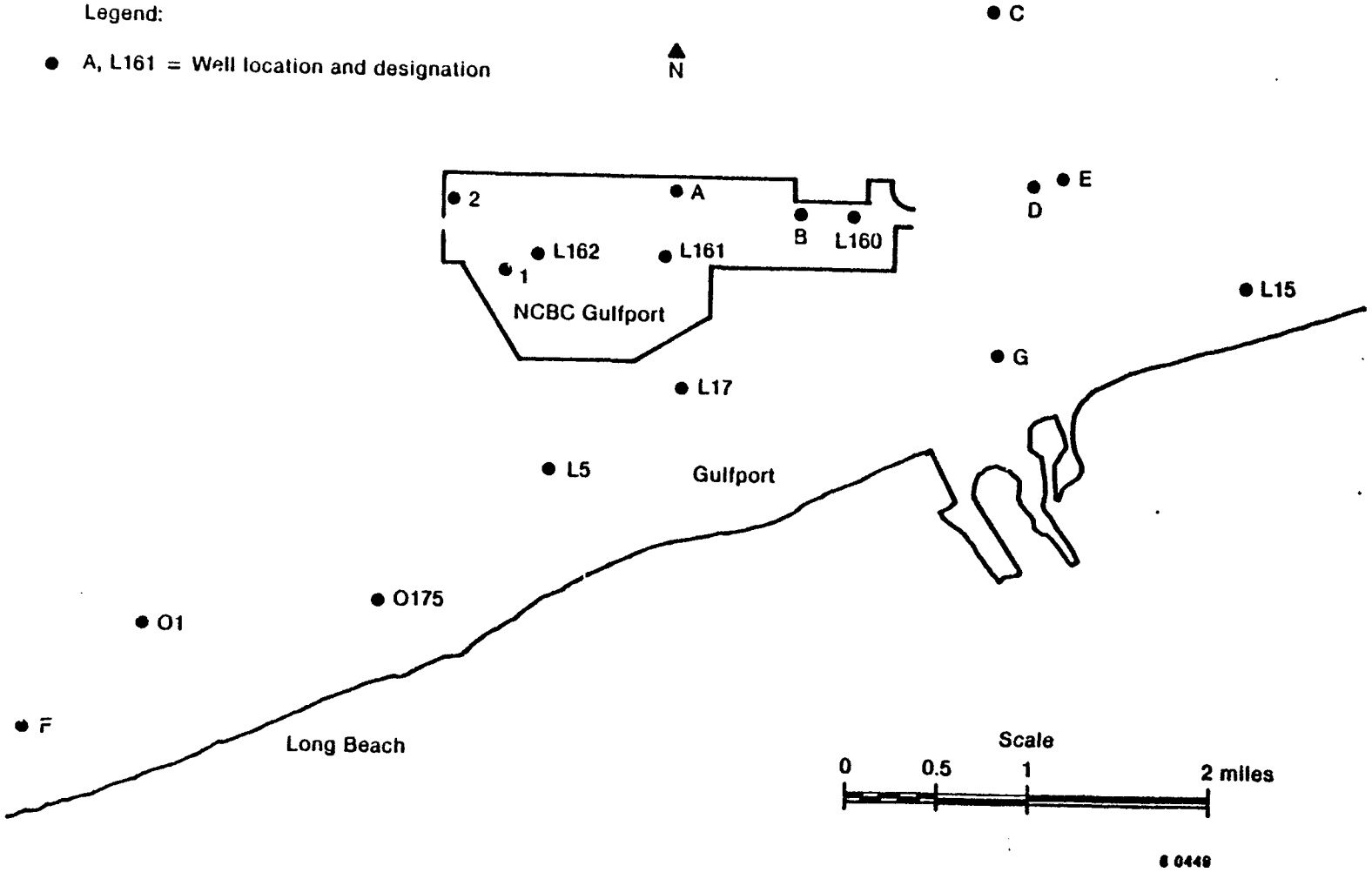

Figure 7. Location of water supply wells.

intermittently since 1971 to replenish water at the golf course lake. Water from the lake is used to irrigate the golf course. The well is approximately 450 feet deep and taps the Miocene aquifer system.

Practice well drilling is carried out on a regular basis by the Naval Construction Training Center in an area approximately 300 yards north of the heavy equipment training area landfill (Site 5). About five wells are drilled per year at a depth of from 85 to 100 feet. The wells, which probably tap the confined Citronelle aquifer, are reportedly free flowing. After drilling, the wells are pulled and collapsed.

The City of Gulfport utilizes a total of 12 wells for its potable water supply, which vary in depth from approximately 750 to 1,000 feet. These wells provide approximately 3.5 million gallons per day of water to the city, and chlorination is the only treatment provided (Reference 14). Six of the wells (Wells C, D, E, G, L17 and L15) are located near NCBC (Figure 7).

The City of Long Beach uses four wells (Wells 01, 0175, L5, and F), which vary in depth from 873 to 926 feet, for its potable water supply (Reference 17).

4. Migration Potential

For clarity, accuracy, and consistency, when discussing migration pathways at NCBC, groundwater aquifers will be generally referred to as surficial aquifer and underlying artesian aquifers. In cases where deep wells obviously tap the Miocene aquifer system, they will be identified as such. The major migration pathways from sites of potential contamination at NCBC include surface runoff and groundwater movement in the surficial aquifer to nearby receiving waters, such as ditches and canals.

Contaminant migration by the surface runoff pathway could occur in areas where the source of contamination is at or near the surface or where erosion problems expose previously buried materials, thereby allowing direct contact with surface runoff.

Many of the potential contamination sites drain to receiving ditches that are adjacent to or in close proximity to the site. This allows relatively direct access of potential contaminants from the ditches to receiving waters, such as Canal Number 1 and Turkey Creek.

Impacts to the ditches on the base would primarily be limited to the aquatic wildlife inhabiting the waters and predators such as raccoons and wading birds that depend on these areas for feeding. In addition, Lilaeopsis carolinensis, a type of parsley, is listed as a rare plant species by the MDWC and has been found in drainage ditches at NCBC during an onsite survey (Reference 3). There is little human contact with these areas since they are used for drainage conveyance, and thus they are relatively isolated from the areas of normal base activities.

Contaminants for potential sites may easily enter the surficial aquifer because of its close proximity to the land surface and the moderate-to-rapid surficial permeability of the soils found in the area. In certain instances, buried materials were reported to be in direct contact with the surficial groundwater.

The flat area around the former HO storage site is a recharge area where rainfall recharges the surficial aquifer. Groundwater moves away from the center of recharge in four directions, depending upon the local conditions. The overall flow direction in all aquifers at Gulfport is southward toward the Gulf of Mexico.

Since no wells at NCBC tap the surficial aquifer, no direct impacts to water supplies are anticipated. Although groundwater movement in the surficial aquifer is primarily lateral due to underlying clayey sediments, there is, however, some potential for contaminant migration

from the surficial aquifer to underlying artesian aquifers. Because of the limited amount of information available regarding potentiometric levels in the numerous underlying artesian aquifers at NCBC, it is not possible to accurately determine the hydraulic potential for downward migration. However, only those wells in the general direction of groundwater flow (south) would receive any groundwater recharge from on-base areas.

Although groundwater contamination on Navy property would be primarily limited to the surficial aquifer, there is, as previously discussed, the potential for migration to the underlying artesian aquifer. Thus, impacts to municipal off-base water supply wells, which tap the Miocene aquifer system at a depth of approximately 750 feet to 930 feet, are possible.

Any potential contamination of on-base areas from off-base sources would be primarily limited to groundwater movement, because there is little surface drainage from off-base areas into NCBC. Because groundwater movement in the underlying artesian aquifers is from north to south, any impact to on-base water supplies would be limited to potential areas of groundwater contamination located north of NCBC. One such potential area is an old City of Gulfport sanitary landfill, which is located approximately 0.8 mile north of NCBC. The landfill was used sporadically since 1969 primarily for the disposal of rubble. In 1980, debris from hurricane Frederic was disposed of there. This landfill is not currently used for municipal or hazardous wastes.

F. CLIMATE

The humid temperate-to-subtropical climate of the Gulfport area is influenced by the Gulf of Mexico to the south and the land mass to the north. Along the coast, the relative humidity monthly means range from 80 percent in January to a low of 72 percent in October. Fog is relatively common, particularly between November and April (Reference 10). In a typical year, the county receives slightly less than two-thirds of the

possible sunshine (Reference 15). Warm temperatures can be expected beginning in May and continuing into September. Temperatures of 90°F or higher have occurred at Gulfport as early as May 4th (1951) and as late as October 16th (1947); the annual mean number of days with such temperatures is 66 (Reference 4). At NCBC, the annual maximum temperature normal is 77.5°F. October through April is relatively mild, with temperatures usually above freezing during the day (Reference 4). Temperatures of 32°F or lower have occurred at Gulfport as early in fall as November 3rd (1966, 27°) and as late as March 27th (1955, 27°F). The annual mean number of days in which the temperature is at or below freezing is 16 days (Reference 4). The annual minimum temperature normal for NCBC is 58.3°F.

Annual rainfall averages 60 inches along the Mississippi coastline. Records from NCBC indicate that September is the wettest month and October is the driest. Thunderstorms average 60 to 80 per year, with occasional torrential rains yielding 12 inches in a 24-hour period (Reference 15). Normally, winter storms are cold and rainy; years may go by with no snowfall or amounts too small to measure (Reference 4).

The mean annual pan evaporation for the Mississippi coastal area is 48 inches, with the average May to October evaporation equal to 66 percent of the total (Reference 18). The prevailing winds are from the south during the spring and early summer, from the east during the late summer, and from the north the remainder of the year (Reference 10). Wind speeds are generally under 10 miles per hour. Wind speeds of 45 miles per hour or more recur approximately every two years (Reference 4).

Tropical storms or hurricanes occasionally pass through the Gulfport area, inflicting wind and flood damage. The most notable in recent years was Hurricane Camille (1969), which had a 23 foot tidal surge. This storm has been estimated to have a recurrence period of 170 years (Reference 5). Hurricane Elena struck on 1985 and caused over 500 million dollars in damage. It was the fourth costliest hurricane on record.

G. TOPOGRAPHY

Harrison County contains two physiographic regions of the East Gulf Coastal Plain. The Coastal Pine Meadows Region, which encompasses NCBC, extends from the shoreline 15 to 20 miles inland and is basically flat with a slight upward sloping to the north. At this somewhat ill-defined boundary, an undulating area of rolling hills known as the Longleaf Pine Hills Region begins. Elevation differences in this area may vary as much as 150 feet between stream-beds and ridgetops (Reference 5).

Most of Harrison County is gently rolling terrain with well-established stream valleys. The drainage pattern is dendritic. Elevations range from sea level on the coast to 230 feet above sea level in the north-central part of the county (Reference 8). At NCBC, elevations typically range from 20 to 35 feet above sea level. The average elevation is about 23 feet above sea level, and there is little topographic relief except near the bauxite piles, which lie just north of the former HO storage site. Those piles are approximately 70 feet above sea level.

Harrison County lies within the 1,560 square mile Coastal Streams Basin, which is mainly bounded by the Pearl River Basin to the west, the Pascagoula River Basin to the north and east, and the Gulf of Mexico to the south (Reference 10). Most of NCBC is located within the 76 square mile Bernard Bayou watershed, a tributary to Biloxi Bay. The watershed area is bounded by the Biloxi River watershed on the north and east, by the Wolf River watershed to the west, and by coastal areas adjacent to the Mississippi Sound on the south (Reference 15). Named tributaries include Brickyard Bayou and Turkey Creek.

H. SOILS

Two soil associations (or map units) constitute the NCBC soils, the Smithton-Plummer association and the Atmore-Harleston-Plummer association. The descriptions given below are from the Soil Survey of Harrison County, Mississippi (Reference 4).

The southeastern portion of the property is typified by the Smithton-Plummer association. That association is on broad flats and in drainageways and depressional areas in the southern part of the county. The areas are about one-fourth mile to more than one mile wide, several miles long, and irregular. Several areas of better-drained soils are on low ridges. Most areas in this association are flooded or have water standing on the surface for long periods. This association makes up about 10 percent of the county. It is about 60 percent Smithton soils, 30 percent Plummer soils, and 10 percent Hyde and Poarch soils. Smithton soils are poorly drained. They have a fine sandy loam surface layer and subsoil. Plummer soils are also poorly drained and have a thick loamy sand surface layer and a sandy loam subsoil.

The Atmore-Harleston-Plummer association typifies the majority of the Navy property. This association, which is in the southern part of the county, is on broad, nearly level flats that are broken by scattered drainageways and numerous low ridges where the soils are gently sloping. Many of the ridges are narrow, and most are less than one-fourth mile wide. This association makes up about 4 percent of the county. It is about 55 percent Atmore soils; 15 percent Harlestone soils; 5 percent Plummer soils; and 25 percent Latonia, Poarch, Ocilla, and Escambia soils. Atmore soils are on the broad flats and in drainageways and depressional areas. They are poorly drained and have a silt loam surface layer and a subsoil that is silt loam in the upper part and becomes clayey with depth. Harleston soils are on the low ridges. They are moderately well drained and have a fine sandy loam surface layer and subsoil. The Plummer soils are poorly drained and have a thick loamy sand surface layer and a sandy loam subsoil.

I. BIOLOGICAL AND ECOLOGICAL RESOURCES

1. Ecosystems

NCBC lies within the physiographic province called the Coastal Pine Meadows. Historically, this region can be characterized as a flat and local swampy belt that meanders along the Gulf Coast, typically ranging from 5 to 15 miles in width, and 5 to 30 feet above sea level.

Groundwater lies near the surface throughout this region, occasionally pooling in depressions during the rainy season. Marshes and swamps associated with this region follow lines roughly parallel to the coast. Saltwater marshes associated with the Pearl and Pascagoula Rivers border this particular region to the west and east. Near the coast are vegetated remnants of former beach dunes that vary in height from 10 to 20 feet (Reference 19). The vegetation typical of this landform is an open growth of pine with an understory characteristic of bogs and pine savannas.

The natural drainages of this coastal area are considered to be tortuous and slow flowing with sandy bottoms and clear, amber-colored waters (Reference 19). These habitat types are characterized below.

a. Pine Savannas

The area in which NCBC and the City of Gulfport are now situated was previously typified throughout by a number of pine species, including the longleaf pine, the loblolly pine, and the slash pine. A number of other tree species are found in some of the drier areas. those species include water oak, live oak, turkey oak, magnolia, sourwood, and leatherwood. The shores of creeks and low, wet depressions typically harbor water tupelo, gallberry, saw palmetto, titi, bald cypress, and southern white-cedar (Reference 19).

Today, the remaining natural areas within the confines of NCBC consists of 401 areas of planted slash pine. The western portion of the property retains many of the original characteristics of the area (flat and swampy) and a number of the original species constituents. Vegetation characteristic or disturbed sites has invaded the understory of most of the wooded area. Noted among the species presently inhabiting the pine areas at NCBC were sweet gallberry, southern magnolia, tallowtree, morning glory, fennel, and golden rod. Where standing water persists, bald cypress and willow were periodically found growing in association with the slash pine stands.

A remnant of a small stand of oak trees occurred near the western side of property on one of the better-drained areas. Live oak and water oak were the most conspicuous species, with occasional tallow trees occurring among them. Fennel and greenbriar were a constituent of the ground cover, while resurrection fern was growing epiphytically on a number of oak limbs. Elsewhere, occurrences of smaller oak trees were scattered.

Because of recent activities, some areas are presently predominated by species characteristic of disturbed areas. Fennel, golden rod, morning glory, poison ivy , poison sumac, and rattlebox were quite common.

A list of common species expected to occur in the Coastal Pine Meadows near NCBC is provided in Table 3.

b. Natural and Artificial Aquatic Environments

No natural drainage systems, such as creeks, are present on the Navy property, though most areas drain off-base. Turkey Creek represents the closest natural drainage system, lying approximately 2,000 feet north of the NCBC property line, which would receive base runoff. This creek is classified by the State of Mississippi as Fish and Wildlife, which is defined as a water for the propagation and management of

TABLE 3. REPRESENTATIVE PLANT, FISH, HERPETOFAUNA, BIRD, MAMMALS FROM THE MISSISSIPPI COASTAL PINE MEADOWS REGION

PLANT		
Black Titi	Titi	Pipewort
Dwarf Huckleberry	Gallberry	Yaupon
Magnolia	Water Tupelo	Wild Olive
Sourwood	Red Bay	Yellow Butterwort
Slash Pine	Longleaf Pine	Loblolly Pine
Spreading Pogonia	Pine-barren Milkwort	Yellow Milkwort
Dwarf Milkwort	Turkey Oak	Laurel Oak
Live Oak	Deer Grass	Swamp Meadow Beauty
Sweet Pitcher Plant	Trumpet-leaf	Yellow-eyed grass
FISH		
Naked Sand Darter	Banded Pygmy Sunfish	Sharpfin Chubsucker
Swamp Darter	Speckled Darter	Banded Darter
Starhead Topminnow	Bayou Killifish	Mosquitofish
Freshwater Goby	Yellow Bullhead	Channel Catfish
Spotted Gar	Bluegill	Redear Sunfish
Spotted Bass	Largemouth Bass	Longnose Shiner
Blacktail Shiner	Blackbanded Darter	Dusky Darter
HERPETOFAUNA		
Cottonmouth	Flatwoods Salamander	Mole Salamander
Green Anole	Common Snapping Turtle	Pond Slider
Southern Black Racer	Southern Dusky Salamander	Ringneck Snake
Corn Snake	Five-lined Skink	Eastern Narrow-mouthed Toad
Mississippi Map Turtle	Green Treefrog	Pine Woods Tree Frog
Mississippi Mud Turtle	Water Snake	Pig Frog
Southern Leopard Frog	Eastern Spadefoot toad	Southern Fence Lizard
Pygmy Rattlesnake	Stinkpot	Box Turtle
Garter Snake		
BIRD		
Red-winged Blackbird	Cattle Egret	Green Heron
Northern Cardinal	Great Egret	Common Nighthawk
Common Bobwhite	American Crow	Blue Jay
Yellow-throated Warbler	American Kestrel	Common Moorhen
Louisiana Heron	Ring-billed Gull	Belted Kingfisher
Red-bellied Woodpecker	Turkey	Northern Mockingbird
Osprey	House Sparrow	Common Grackle
King Rail	Rough-winged Swallow	Foster's Tern
Eastern Meadowlark	Carolina Wren	Eastern Kingbird
Mourning Dove		

TABLE 3. REPRESENTATIVE PLANT, FISH, HERPETOFAUNA, BIRD, MAMMALS FROM THE MISSISSIPPI COASTAL PINE MEADOWS REGION (CONCLUDED)

MAMMALS

River Otter	Bobcat	Striped Skunk
Mink	Eastern Woodrat	Whitetail Deer
Muskrat	Rice Rat	Cotton Mouse
Raccoon	Black Rat	Eastern Harvest Mouse
Eastern Gray Squirrel	Eastern Fox Squirrel	Cotton Rat
Spotted Skunk	Swamp Rabbit	Eastern Cottontail
Gray Fox		

fish and wildlife. The vegetation associated with Turkey Creek is typical for the region. Some of the more common hardwood species include titi, black titi, red bay, red maple, tupelo gum, bald cypress, and willow (Reference 19).

Man-made lakes and drainage ditches at NCBC are habitat for a number of species. Since these areas appear to be periodically maintained, most of the wetlands vegetation associated with their borders tend to remain artificial or at early successional stages. Some of the plant species found in or adjacent to the environment at the Navy property include rattlebox, cattail, morning glory, unidentified pipewort, pennywort, willow, and unidentified grasses. A rare plant, Lilaeopsis carolinensis, was also observed inhabiting some of the grassed ditches during an onsite investigation (Reference 3).

c. Fauna

Turkey, deer, fox, and skunk are occasionally sighted just off Navy property. Two interviewees stated that an alligator inhabits one of the golf course lakes (Reference 3).

The NCBC lakes and sewage lagoons are maintained for recreational fishing. These are presently stocked with largemouth bass, bluegill, redear sunfish, and channel catfish.

During an onsite survey (Reference 3), a number of fauna species (or evidence of them) were observed. Several turtles were seen in drainage ditches and the reclaimed sewage lagoons. The great egret and cattle egret used the aquatic habitats for foraging. Raccoon tracks were found at various locations on NCBC, particularly near the aquatic habitats. Rabbit scat was common in wooded areas, suggesting that at least one species of rabbit is present in moderate numbers on Navy property.

The Gulf area has a distinct strand of flora containing a number of tropical and subtropical species (Reference 19) that provide a diverse and suitable habitat for a number of fauna. A list of representative species for the Coastal Pine Meadows of Mississippi is provided in Table 3.

2. Endangered, Threatened, and Rare Species

The U.S. Fish and Wildlife Service (USFWS) through the U.S. Endangered Species Act of 1973 (16 USC 1531) and the Mississippi Department of Wildlife Conservation through the Non-Game and Endangered Species Act (Section 49-5-101 through 119, Mississippi Code of 1972) have each promulgated a list of biota legally protected in the State of Mississippi. Respectively, these are the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 and 17.12), and the Official State List of Endangered Vertebrates (Public Notice No. 2408). Presently, the State of Mississippi has no official State list for protected plant species (Reference 3).

The Mississippi Natural Heritage Program (NHP), an affiliate of the Mississippi Department of Wildlife Conservation (MDWC), has compiled a data base that is the most complete, single source of information about Mississippi's rare, threatened, endangered or otherwise significant plants, animals, plant communities, and natural features (Reference 20). Although the complete inventory of species is currently not assigned a legal status, the program is recognized statewide and given consideration.

The status designations are defined by the NHP as follows:

> Endangered - A species which is in danger of extinction throughout all, or a significant portion, of its range in the state due to (a) destruction, drastic modification or severe curtailment of habitat; (b) its overutilization for commercial or sporting purposes; (c) effect of disease or pollution; or (d) other natural or manmade factors.

Threatened - A species which may become endangered within the foreseeable future in all, or a significant portion, or its range in the state for the same reasons as set out above for endangered species.

Rare - A rare species is one that, although not presently threatened with extinction, is in such small numbers throughout its range in Mississippi, it may be threatened or endangered if its environment worsens. Close watch of its status is necessary.

a. Fauna

The USFWS lists twenty species of animals in Mississippi as endangered or threatened. Of these, five are recorded from the Coastal Pine Meadows of Harrison County. The MDWC has classified 39 species of animals as endangered statewide. Of these, three species in addition to the five accounted for in the Federal listing are known from the region. The NHP presently lists 110 species as endangered, threatened, or rare. The data base of the NHP indicates nine other species, in addition to those considered by the USFWS and the MDWC, are known from the Coastal Pine Meadows. Therefore, 17 species are considered rare, threatened, or endangered by the USFWS, the MDWC, or the NHLP. Those 17 species are listed in Table 4. Table 4 also indicates if those species are likely to be found on either the NCBC property or the former HO storage site.

b. Flora

Neither the USFWS nor MDWC lists any endangered or threatened plant species that occur in the State of Mississippi. There are 221 species of plants listed as either endangered, threatened, or rare by the NHP. A computer search of its data base (Reference 20) indicates that 16 of these species have been recorded in the Coastal Pine Meadows of Harrison County. (See Table 5.) At least one of these (Lilaeopsis

TABLE 4. LIST OF ENDANGERED, THREATENED AND RARE ANIMAL SPECIES OF THE COASTAL PINE MEADOWS REGION

Common Name	USFWS	State	NHP	Habitat Found on NCBC Property?	Habitat Found on HO Site?
Mammals:					
Southeastern Shrew			R	Yes	No
West Indian Manatee	E	E	E	No	No
Birds:					
Snowy Plover		E	R	No	No
Reddish Egret			R	Yes	No
American Oystercatcher			R	No	No
Bald Eagle	E	E	E	Yes[c]	No
Black Rail			R	No	No
Brown Pelican	E	E	E	No[c]	No
Least Tern			R	No[c]	No
Reptiles and Amphibians:					
American Alligator	E	E	E	Yes	No
Scarlet Snake			R	Yes	No
Southern Hognose Snake		E	E	Yes	No
Scarlet Kingsnake			R	Yes	No
Atlantic Ridley Turtle	E	E	E	No	No
Yellow-lipped Snake			R	Yes	No
Fish:					
Atlantic Sturgeon		E	E	No	No
Striped Bass			R	No	No[b]

a. As classified by the Mississippi Natural Heritage Program.

b. Possibly affected by Surface Drainage.

c. But could sometimes visit NCBC.

USFWS - U.S. Fish and Wildlife Service
NHP - Mississippi Natural Heritage Program
E - Endangered
T - Threatened
R - Rare

TABLE 5. LIST OF ENDANGERED, THREATENED, AND RARE PLANT SPECIES OF THE COASTAL PINE MEADOWS REGION

Common Name	NHP	USFWS/State	Habitat Found on NCBC Property?	Habitat Found on HO Site?
Plants:				
Spreading Pogonia	R	None	Possible	No
Balsam scale	R		Possible	No
Green Fly Orchid	R		No	No
Pipewort	R		Possible	No
Dangleberry	R		Possible	No
Parsley	R		Yes	Possible
Paspalum	R		Possible	No
Prairie Clover	R		Possible	No
Butterwort	R		No	No
Large White Fringed-Orchid	R		Possible	No
Crested Fringed-Orchid	R		Possible	No
Clammy-Weed	R		No	No
Milkwort	R		Possible	No
Murtle Oak	R		No	No
Beak Rush	R		Possible	No
Giant Spiral-Orchid	R		Possible	No

USFWS - U.S. Fish and Wildlife Service
NHP - Mississippi Natural Heritage Program
E - Endangered
T - Threatened
R - Rare

carolinensis) was found at NCBC during an onsite survey (Reference 3). It is not likely that any of those species would be found on the former HO storage site.

J. SOCIOECONOMIC CONDITIONS

The population of Gulfport and the surrounding areas is listed in Table 6.

Throughout the area, the racial mix is approximately 16 to 19 percent black and 78 to 80 percent white (Reference 21). NCBC has an assigned population of approximately 5500 persons, including military personnel, civilians, and their dependents. The actual population, however, is closer to 4000 persons because typically two battalions are in deployed status and are thus not located at NCBC (Reference 21).

Kesler Air Force Base, located approximately 10 miles east of Gulfport, has a total on-base population of approximately 25,800 persons, which includes both military and civilian personnel.

Approximately 69 percent of the adult white population and 48 percent of the adult black population has a secondary school education. For comparison, 34 percent of the adult white population and 18 percent of the adult black population have a high school education in the state of Mississippi (Reference 21).

The principal source of personal income in Harrison County is by local, state, and federal government employment, including employment as a result of NCBC. Approximately 30 percent of the total dollars earned in Harrison County is obtained from government sources. Government-related employment makes up approximately 28 percent of the labor force (Reference 22).

TABLE 6. POPULATION OF GULFPORT AND SURROUNDING COMMUNITIES

Biloxi		49,311
D'Iberville		13,311
Gulfport		39,676
Long Beach		7,967
Pass Christian		5,014
Unincorporated County		42,386
	Total	157,665

The principal source of private employment is wholesale and retail trade, manufacturing, and service-related occupations. The principal manufacturer in the area and their products are listed in Table 7 (Reference 22).

The per capita income for Harrison County is $5144. In comparison, the state of Mississippi has a per capita income of $5183 (Reference 21).

K. ARCHEOLOGICAL AND HISTORICAL RESOURCES

Evidence of human habitation dating back thousands of years can be found throughout the Gulf region. Archeological sites have been found in all counties and parishes bordering the Gulf. The three coastal Mississippi counties record 106 archeological sites, with 38 reported in Harrison County (Reference 23). None of those sites, however, is found on NCBC (Reference 24).

Perhaps the most notable ancient dwellers of the region were the Choctaw nation of American Indians. They descended from the Chickemacaws who were among the first inhabitants of the Mexican empire (Reference 25). Today, most Choctaw Indians live on one of two reservations located in Tuskahoma, Oklahoma, and near Philadelphia, Mississippi.

Recorded history dates back to the French Canadian Lemoyne brothers who explored the area in 1679. They established a permanent settlement in Biloxi prior to the founding of New Orleans, Louisianna or Mobile Alabama.

In 1855, William H. Hardy, a former Confederate captain, purchased 5000 acres of coastal land and founded the town of Gulfport. Hardy attempted to build a railroad to the inland yellow pine forest around Hattiesburg. Financial troubles overtook Hardy so Captain Joseph T. Jones reorganized the company and completed a railroad from Gulfport to Jackson Mississippi.

TABLE 7. PRINCIPAL MANUFACTURING EMPLOYERS IN THE GULFPORT AREA

Name	Product or Service	Number Employed
Gulf Publishing Co	Newspapers	380
Paceco, Inc.	Cranes, dam gates	330
Ce-Natco	Pressure vessels	250
Colonial Baking Co	Bread and rolls	218
Gulf Wire, Inc.	Auto wiring harnesses	213
Maybelle Dress Mfg.	Ladies sportswear	200
McDermott Shipyard	Shipyard	200
Struthers Wells-Gulfport	Shell heat exchangers	175

In 1897, a 4500 foot pier was completed at the railroad terminal in Gulfport. Captain Jones then financed the completion of the Gulfport Harbor, which was completed in 1902. Subsequently, Gulfport became the world's largest exporter of long leaf yellow pine and the United States' leading banana importer (Reference 22).

As a result of Gulfport's history, six landmarks have been listed on the National Historic Register. The most notable is Beauvoir, the last home of the Confederate President Jefferson Davis. None of the six historic sites lies near NCBC.

SECTION IV
POTENTIAL DIRECT ENVIRONMENTAL CONSEQUENCES

A. AIR EMISSIONS

The incinerator will produce small amounts of particulate and hydrochloric (HCl) gas. Those pollutants will be removed by the air pollution control system, which includes a wet scrubber. The expected emissions from the incinerator are less than 0.02 grains/dscf particulate and 0.0016 grams/hr of HCl. Currently, there are no HCl emission standards for incinerators. Also, the particulate emission standards apply only to very large incinerators. The proposed incinerator's scrubbing system, however, will easily meet the large incinerator particulate standard as well as removing nearly all of the HCl gas.

Although there is no current air quality standard for dioxin pertaining to incinerators, the concentration of dioxin in the proposed incinerator's off-gas is expected to be nondetectable when measured to a sensitivity of 0.1 ppb. This is a realistic expectation based upon data obtained from the EPA's mobile waste incinerator system (Reference 26), which has a very similar process. Furthermore, research has shown (Reference 27) that complete dioxin destruction can be achieved if the compound is incinerated at 2200°F, with a residence time of 2.2 seconds. The proposed incinerator meets or exceeds these requirements.

Table 8 lists the expected emission rates for the MWP-2000.

B. WATER EMISSIONS

The incineration process will produce 3 gallons per minute of waste water, which comes primarily from the scrubbing process. That water will contain small amounts of HCl and particulate matter. The HCl will be in such low concentrations that neutralization will not be necessary. That water will be applied to either the clean or contaminated soil for disposal

TABLE 8. EMISSION RATES FOR THE MWP-2000

Component	Emission Rate
Particulate	<0.02 grains/dscf
Water vapor	7285 lbm/hr
CO_2	4923 lbm/hr
N_2	24400 lbm/hr
SO_2	9 lbm/hr
O_2	2204 lbm/hr
HCl	16.4×10^{-6} gram/hr

and dust control. It will be evenly applied to the soil in small quantities to preclude a surface runoff problem. Land application of the waste water should not cause any deleterious effect to either Turkey Creek or to the groundwater. The water discharged will be analyzed and delisted according to applicable EPA regulations before discharge.

C. EFFECTS TO RARE, THREATENED, OR ENDANGERED BIOLOGICAL RESOURCES

This section describes the potential impacts to the rare, threatened, or endangered species indigenous to the Gulfport region.

1. Birds

As previously discussed in Section III-I, a variety of rare birds frequent the Gulfport and NCBC areas; however, only three species are likely to be observed at the former HO storage site. Those species are the southern bald eagle, the eastern brown pelican, and the least tern. The former HO storage site does not provide good habitat for those species; their observation would be due to chance straying from their preferred habitats of the nearby Gulf Coast and Biloxi Bay. Also, there are no known bird nesting areas on the former HO storage site. Therefore, the proposed project will have no deleterious effect on any bird population.

2. Mammals

The only rare, threatened, or endangered species that would find suitable habitat on the NCBC property is the Southern Shrew, which is classified as rare. The former HO storage site, however, does not provide suitable habitat for the shrew. Therefore, this project will have no deleterious effect on that species.

3. Reptile

Section III-I describes the rare or threatened reptilian species which could find suitable habitat on NCBC property. Of those five species, none would find suitable habitat on the former HO storage site. Therefore, the proposed project would have no deleterious effect on those species.

4. Fish

Neither the former HO storage site nor NCBC provide habitat for any endangered or rare fish species. Surface drainage from the site, however, flows into Turkey Creek and onto Biloxi Bay. That runoff water could potentially be affected by the soil handling activities at the site, which in turn could effect the indigenous fish populations. To prevent contaminated silt from entering the surface waters, the soil handling plan will be strictly followed. No deleterious effect on the fish population or the Biloxi Bay is foreseen as a result of the proposed project. This project will have a beneficial effect on the fish by eliminating any potential for dioxin-contaminated soil to enter Turkey Creek.

5. Vegetation

Section III-I describes the plant species that are considered rare or threatened. Due to habitat restrictions, only the dangleberry could potentially be found on the former HO storage site. An informal investigation of the site did not indicate the presence of dangleberries. Therefore, the proposed project will have no deleterious effect on plant life considered to be rare or threatened.

D. SOCIOECONOMIC IMPACTS

Less than 21 persons will be employed as a result of this project. Those employees will be temporary because the project is expected to last only five to six months. Thus, they will probably not bring their families

with them. Therefore, the local school system will not be affected, and the local housing market will be minimally affected.

The local economy will see an almost insignificant increase in retail sales resulting from the employees' personal needs. Spare parts for the incinerator may occasionally be purchased locally.

E. AESTHETIC EFFECTS TO THE NCBC AND GULFPORT REGION

NCBC is a heavily developed site. The area surrounding the HO storage site is dedicated to heavy equipment storage and bauxite storage piles. Additionally, the project is of short duration. Therefore, there will be no adverse impacts on aesthetics from this project.

F. EFFECTS TO ARCHEOLOGICAL AND HISTORICAL RESOURCES

The proposed project will lie entirely within the confines of NCBC. An archeological survey performed in 1984 (Reference 24) showed that there are no archeological sites or registered national historic landmarks on NCBC. Furthermore, because this project will have minimal offsite impact, it will have no effect on the archeological or historical resources outside NCBC.

G. ENVIRONMENTAL EFFECTS RESULTING FROM POSTULATED ACCIDENTS

An abbreviated safety analysis is presented in the RD&D Permit Application (Reference 1). The analysis indicates that failures such as loss of burner flame or loss of primary electrical power would not pose a dioxin exposure risk to the environment or the public health. The maximum hypothetical accident was described as a worst-case accident of unknown origin that would cause an explosion in the incinerator system. Because of the system's safety interlocks and procedures, such an accident is hypothetical. If it should occur, however, equipment operators would

immediately discontinue feeding contaminated soil to the kiln. Because of thermal inertia, the kiln and secondary combustion temperatures would remain very high. Therefore, any vaporous dioxin desorbed from the soil would still be incinerated. The postulated explosion could scatter contaminated dust into the air. Those fugitive emissions, however, would be very short-lived because the dust would settle out quickly. The injuries sustained to workers as a result of such an explosion would be more serious than any potential dioxin exposure.

Damage to the incinerator due to tornadoes or hurricane force winds is an anticipated event. However, the NCBC emergency preparedness manual (Reference 28), which specifically addresses destructive weather emergency procedures, calls for shutdown of all NCBC operations and evacuation of all nonessential personnel. Because this project falls under the authority of the NCBC base command, the applicable destructive weather emergency procedures will be followed. Accurate weather forecasting will allow sufficient advance notice to shutdown the incinerator, to secure the area, and to evacuate nonessential personnel. Although wind damage to the incinerator and ancillary devices would be expected, that damage would only cause programmatic difficulties and would not result in adverse environmental or public heath consequences.

SECTION V
POTENTIAL INDIRECT CONSEQUENCES

A. POTENTIAL EFFECTS TO OPERATIONS AT NCBC

1. Utilities

The most significant effect on the NCBC utilities caused by the proposed project will be on the natural gas system. Currently, NCBC natural gas usage varies from a high of 32,000 MBtu/quarter in the winter months to 12,000 MBtu/quarter during the summer months. This corresponds to a usage of approximately 10,600 MBtu/month in the winter. The MWP-2000 incinerator has two burners with a combined heat input of 34 MBtu/hr. If the incinerator is operated continuously, the monthly gas usage would be 24,500 MBtu/month. This rate will more than triple the total natural gas consumption rate of the base.

Although the incinerator will use a significant quantity of natural gas, the effect on NCBC will be minimal. The proposed incinerator would obtain the required gas from an existing natural gas line located approximately 60 feet south of Greenwood Ave. That line is large enough to provide sufficient gas for the needs of NCBC as well as the incinerator.

An analysis is currently underway to determine the applicability of using liquefied petroleum gas (LPG) in the incinerator. If LPG is used, it would be delivered in a railcar which would be parked on one of the spurs near the former HO storage site. The decision to use LPG or natural gas will be based upon safety and economics.

Natural gas or LPG is the preferred fuel because of its low cost, ease of transportation, and clean burning characteristics. Additions to the natural gas line would be installed and tested according to the applicable National Fire Protection Association codes. Also, a gas meter would be installed on the incinerator feed line so that gas usage may be accounted for and billed accordingly.

The only viable alternate fuel is fuel oil that would require truck or rail tanker transportation. If fuel oil was obtained from a mobile tanker, an expensive spill prevention and control berm would be required.

The proposed incinerator will also use approximately 34 gallons per minute of domestic water. This corresponds to approximately 49,000 gallons/day. That water will be supplied from a fire hydrant located approximately 60 ft. south of Greenwood Ave. A 3 in. line will transport the water from the fire hydrant to the incinerator.

The incinerator's water usage will have no significant effect on the base's total water consumption rate of 330,000 gallons/day. Furthermore, water main which supplies the fire hydrant is sufficiently large to provide adequate water supply for the incinerator, domestic use, and fire fighting needs.

The proposed incinerator will also use approximately 76 kW/hr of electricity to turn the kiln, run the blowers, and supply power for the instrumentation, the computer, and miscellaneous other needs. Currently, NCBC uses a maximum of 6440 MWhr/quarter or approximately 2140 MWhr/month during their peak usage period in the summer. Because the incinerator will only use 55 MWhr/month, the additional electric usage will be small compared to the total NCBC needs.

2. Operations

The primary missions of NCBC are the support of five battalions of the Naval Construction Force and the storage and maintenance of pre-positioned war reserve material stock. The area surrounding the former HO storage site is either vacant or is used as a parking area for heavy equipment. Approximately 300 yards to the north of the site is the world's largest stockpile of bauxite ore, which was obtained after World War II as war reparations.

The presence of additional operations posed by this project will not impact any operations adjacent to the former HO storage site. The completion of this project will improve the function of NCBC by restoring the site and allowing it to be used for other purposes.

With the exception of the utilities described above, the proposed project will use no manpower or material resources from the general operations of NCBC.

B. CONSTRUCTION AND DEMOLITION WASTE DISPOSAL

The MWP-2000 incinerator is a mobile unit mounted on four tractor trailer trucks. It is designed as a stand-alone system and does not require a permanent foundation for setup prior to operation. Due to the possibility of high winds or hurricanes, however, local building codes require that house trailers be secured to the ground with metal straps or cables. Therefore, the laboratory trailer, the control room trailer the decontamination trailer, and the four incinerator trailers will be secured to the ground according to local building codes. Those temporary foundations are the only foreseeable construction waste because they will be left onsite upon project completion. They, however, will be covered with plastic prior to use. Upon completion of the project, those temporary foundations will be removed. If they are contaminated, they will be disposed in accordance with the applicable regulations. If they are not contaminated, they will be disposed in the NCBC landfill.

All other waste produced as a result of incinerator operation, such as anticontamination clothing, will be processed in the incinerator.

SECTION VI
CONCLUSIONS

The proposed full-scale demonstration project will have no significant impact to the environment for the following reasons:

- The project will only last 120 days.
- The former HO storage site is not located in an environmentally sensitive area.
- The air pollution control system is properly designed and constructed.
- Analysis of the processed soil will ensure that only soil meeting the EPA delisting criteria is returned to the excavated areas of the former HO storage site.

Furthermore, by removing the dioxin contamination hazard from the former HO storage site, the proposed project will improve the environment by not only eliminating the human health hazard, but also by eliminating the possibility of spreading dioxin contamination to offsite areas.

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APPENDIX W

RESEARCH DEVELOPMENT AND DEMONSTRATION (RD&D) PERMIT NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT MISSISSIPPI MS2 170 022 626

The document contained in this appendix is the final permit issued by EPA Region IV. This document was reproduced from the best available copy. Due to poor legibility, the legibility of the microfiche edition is also poor. To avoid duplication of redundant information, the attachments referred to in the permit are numerous places throughout the report.

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Report Title: Full-Scale Incineration System Demonstration Verification Test Burns at the Naval Construction Battalion Center, Gulfport, Mississippi: Treatability Tests

Report Number: ELS-TR-88-61, Volume: II, Part: 5, Appendix: W

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

NOV 23 1987

4WD-RCRA

Major Terry Lee Stoddart
HQ AFESC/RDVW
Tyndall AFB, Florida 32403

RE: Renewal and Revision of RCRA RD&D Permit
Naval Construction Battalion Center, Gulfport, Mississippi
EPA I.D. No. MS2 170 022 626

Dear Major Stoddart:

Enclosed is the revised Research, Development, and Demonstration (RD&D) permit under the Resource Conservation and Recovery Act (RCRA) for the above referenced facility. This permit was originally issued on July 2, 1986, for the purpose of conducting research activity at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. Specifically, the technical efficiency and cost-effectiveness of using mobile incinerator technology for treatment of dioxin contaminated soil was to be demonstrated under this project.

The original permit is being revised to include new operating conditions for the incinerator and to include additional requirements for ambient air monitoring, operation of the thermal relief vent and additional analyses for the treated soil. The revised conditions are described below:

1. The operating conditions for the incinerator (Permit Condition III.E.) were based on data from an identical unit at El Dorado, Arkansas. EPA was informed in January 1987 that the data from the El Dorado, Arkansas unit was invalid. Therefore, on May 11-16, 1987, a RCRA dioxin trial burn was conducted at NCBC to determine the correct operating conditions. The results from the trial burn were submitted on July 23, 1987, with subsequent revisions dated August 18, 1987, and October 19, 1987, respectively. Permit Condition III.E. has been revised to reflect the new operating conditions based on the May 1987 trial burn results.

2. Permit Condition III.F. has been added concerning operation of the thermal relief vent (TRV). This permit condition specifies when the TRV can be used and also the operating conditions for the incinerator when the TRV is in use. Specifically, the TRV can only be opened for one of the following reasons:

   a) Steam drum water level falls to 0%.
   b) Exit temperature of waste heat boiler exceeds 600°F
   c) Inlet temperature of packed tower exceeds 220°F

The minimum operating temperature of 2150°F must be maintained in the secondary combustion chamber whenever the TRV is open. If the TRV is opened for any other reason, then operation cannot resume without approval from EPA.

3. Permit Condition III.G. has been added concerning ambient air monitoring during soil excavation. The condition states that the Permittee shall follow the ambient air monitoring plan outlined in Attachment IX. Specifically, Condition III.G. and Attachment IX specifies the following:

   a) Ambient air will be monitored on a 24-hour basis during the first thirty (30) days of excavation. (Please note that reference to "first (30) days of operation" has been changed to "first 30 days of excavation," pages 18, 19, 20, and 24, respectively of Attachment IX).

   b) Ambient air monitors shall be placed as specified in Table 3-1 and Section 3.2 of Attachment IX.

   c) Soil excavation must stop until appropriate dust suppression measures are taken if hourly mini-ram or 24-hour Hi-Vol readings exceed 3 times background for total suspended particulates. Background will be established on a daily basis at the upwind sampler (Sampler A in Table 3-1).

   d) Soil excavation must stop if TCDD levels, as measured by the 24-hour PUF samplers, exceed 3 pg/m^3. Excavation may not resume without approval from EPA.

   e) Hi-vol and mini-ram readings shall be used to evaluate the need for dust suppresion throughout excavation activities for the project.

4. Permit Condition III.H. has been added to specify due dates for the following reports:

   a) Evaluation of waste feed rate versus auger rpm

   b) Summary report for the first 30 days of excavation under the ambient air monitoring plan.

   c) Comparison of soil moisture content as calculated with ASTM Method D 2216-80 and the infrared moisture analyzer.

   d) Results from the comprehensive chemical analyses on treated ash residue.

5. Permit Condition II.I. and Attachment VIII have been revised to clarify the sampling procedure for treated ash residue. Permit Condition III.I. has also been revised to include comprehensive analysis on the treated soil every 30 days of operation.

The revisions described above are minor modifications under 40 CFR §270.42. A summary of the revised conditions is also enclosed.

This letter also serves to clarify effective dates for the permit. The permit specifies 150 operating days and is effective August 4, 1986, through August 4, 1987. 40 CFR §270.65 provides that RD&D permits may be issued for the 360 operating days; since the original permit limit of 150 operating days have not been used, we are extending the expiration date to August 4, 1988, for completion of the project. Please note that permit renewal under 40 CFR §265.65(d) (which includes public participation provisions under 40 CFR Part 124) must be implemented if the RD&D project is not completed within 150 operating days.

If there are questions concerning any of the above, please call Mr. Douglas C. McCurry of my staff at (404)347-3433.

Sincerely yours,

Douglas C. McCurry for

Patrick M. Tobin, Director
Waste Management Division

Enclosures

cc: Sam Mabry, Mississippi Department of Natural Resources

REVISED PERMIT CONDITIONS

CONDITION II.I. EXPERIMENTAL PROCEDURES
(revised permit condition)

1. The Permittees shall follow the experimental procedures set forth in Attachment I.

2. The Permittees shall handle all scrubber waters from the incinerator as described in Attachment VII.

3. The Permittees shall handle all treated soil from the incinerator as specified in Attachment VIII.

   a. Soil samples shall be obtained as specified in Appendix B of Attachment VIII.

   b. Within one (1) week of operation, a 24-hour composite sample of treated soil shall be analyzed for the parameters outlined in Attachment 4-A of Attachment XI. The analysis in Attachment 4-A shall be repeated each 30 days following the initial analysis. Sample procedures shall be those specified in Appendix B of Attachment VIII. Footnote "e" of Attachment 4-A shall be complied with by following the analytical methods specified in Attachment 4-B, (Attachment 4-B is in Attachment XI).

CONDITION III.D. LIMITATION ON WASTES
(revised permit condition)

The Permittees shall treat with incineration the following hazardous wastes:

Waste Code Number	Description	Feed Rate
F027	Soil contaminated with Herbicide Orange	0-5.3 tons/hr
	Miscellaneous combustible (wooden pallets) and noncombustible (concrete/ drums) refuse present on the storage area. Residues and equipment resulting from chemical treatment described in Attachment I.	

CONDITION III.E. OPERATING CONDITIONS
(revised permit condition)

The Permittees shall feed the waste described in Condition III.D. to the incinerator only under the following conditions:

1. The rotary kiln temperature, as measured by the outlet gas thermocouple (TE-121), shall be maintained above 1450°F.

2. The secondary combustion chamber temperature, as measured by the outlet gas thermocouple (TE-223), shall be maintained above 2150°F.

3. The secondary combustion chamber residence time, calculated from Equation 16 in Attachment X, shall be maintained above 1.65 seconds.

   a. The soil feed rate in lbs/hr shall be calculated and input to the Data Aquisition System (D.A.S.) each 8-hour shift.

   b. The soil moisture content shall be measured with the infrared analyzer, as described in Attachment X. If the infrared device fails, then moisture content shall be calculated and input to the D.A.S. each 8-hour shift using ASTM Method D2216-80.

4. Maximum stack gas carbon monoxide (CO) concentration, measured as specified in Attachment I, shall not exceed 50 ppm for more than six (6) minutes accumulative every clock hour, or 500 ppm maximum at any time.

5. Maximum auger speed, measured at the auger hydraulic motor gear (SE-137), shall not exceed 5.8 rpm.

6. Packed tower scrubber water recirculation flowrate, measured at the distribution headers (FE-415) shall be maintained above 132 gallons/minute.

7. Ejector scrubber water recirculation flowrate, measured at the ejector scrubber inlet (FE-422), shall be maintained above 35 gallons/minute.

8. Kiln pressure, as measured at the exit of the kiln (PT-124) shall not exceed -0.05 inches of water for more than 15 seconds.

9. The Permittees shall operate the incinerator to immediately cut off hazardous waste feed when any of the following occur:

   a) Kiln temperature, as measured in Condition III.E.1. falls below 1450°F.

b) Secondary combustion temperature as measured in Condition III.E.2. falls below 2150°F.

c) Residence time, as calculated in Condition III.E.3. falls below 1.65 seconds.

d) Stack gas carbon monoxide (CO) level, as measured in Condition III.E.4. exceeds 50 ppm for more than 6 minutes accumulative every clock hour, or 500 ppm maximum at any time.

e) Maximum auger speed, as measured in Condition III.E.5., exceeds 5.8 rpm.

f) Packed tower scrubber water recirculation flowrate, measured in Condition III.E.6., falls below 132 gallons/minute.

g) Ejector scrubber water recirculation flowrate measured in Condition III.E.7., falls below 32 gallons/minute.

h) Kiln pressure, measured in Condition III.E.8. exceeds -0.05 inches of water for more than 15 seconds.

i) The Data Aquisition System (D.A.S.) fails and cannot calculate residence time.

j) The following incinerator monitoring equipment fails:

1. Thermocouple TE-121
2. Thermocouple TE-223
3. O_2 analyzer
4. CO analyzer
5. Kiln natural gas flow meter
6. Secondary combustion chamber natural gas meter

k. The solids feed weigh hopper fails and cannot be fixed within 15 minutes.

10. During start-up and shut-down of the incinerator, hazardous waste must not be introduced into the incinerator unless the incinerator is operating within the conditions specified in Conditions III.E.1. through 8.

11. The Permittees shall monitor the facility, as specified in Attachment I.

12. In the event of loss of flame in the secondary combustion chamber, the Permittees must restore flame within three (3) minutes. Temperature in the SCC must be maintained at 2150°F until all* solids exit the kiln.

13. The CO and O_2 continuous emission monitors shall be calibrated daily with zero and span gases. Zero gas shall be 0 to 10% of full scale and span gas shall be 80 to 100% of full scale.

CONDITION III.F. THERMAL RELIEF VENT
(new permit condition)

The thermal relief vent shall only be used in emergency situations which could endanger downstream pollution control equipment and only after all waste feeds have been cut off. The following failure modes are emergency situations where the Permittees may use the thermal relief vent:

1. Steam drum water level on the waste heat boiler falls to zero (0) percent.

2. Exit temperature of the waste heat boiler, as measured by thermocouple TE 409, exceeds 600°F.

3. Inlet temperature of the packed tower, as measured by thermocouple TE 321, exceeds 220°F.

The Permittees shall minimize emissions during a TRV event by maintaining temperature in the secondary combustion chamber at 2150°F until all* solids exit the kiln. Within 24 hours after an event in which the thermal relief vent is opened, the Permittees shall be required to verbally report the incident to the Regional Administrator. A written report will be required within fifteen (15) days to explain the reason for the incident and actions being taken to prevent the situation from recurring. If the TRV is opened for any reason other than the three (3) failure modes listed above, the Permittees shall not be allowed to resume feeding hazardous waste to the incinerator until approval is received from the Regional Administrator.

*The requirement for all solids to exit the kiln shall be considered met if kiln rotation is maintained at or above .5 rpm for twenty (20) minutes.

CONDITION III.G. AMBIENT AIR MONITORING PLAN
(new permit condition)

1. The Permittees shall follow the ambient air monitoring plan outlined in Attachment IX.

2. The Permittees must immediately stop excavation if PUF Sampler C exceeds the 2,3,7,8-TCDD action level of 3 pg/m^3 as described on page 18 of Attachment IX. The Permittees may not resume excavation until approval is received from the Regional Administrator if the action level is exceeded.

CONDITION III.H. SUBMITTAL OF INTERIM REPORTS
(new permit condition)

1. The Permittees shall evaluate bulk average waste feed rate (as measured by the weigh hopper) versus auger rpm for the first fourteen (14) days of operation. This data shall be submitted to the Regional Administrator within ten (10) days of compliance. The data will be used to evaluate the accuracy of auger rpm as the indicator of waste feed rate (Condition III.E.5.).

2. The Permittees shall continue ambient air monitoring with the PUF samplers as described in Section 3.3.2 of Attachment IX until the Regional Administrator approves the summary report and revised sampling plan described on page 24 of Attachment IX.

3. The Permittees shall submit the waste feed moisture analysis comparison data described in Attachment X within five (5) days.

4. The Permittees shall submit results from the treated soil analyses under Condition II.I.3.b. within fourteen (14) days of the analysis.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH, DEVELOPMENT AND DEMONSTRATION PERMIT
FOR HAZARDOUS WASTE TREATMENT

Permittees: U.S. Navy
U.S. Air Force
Permit Number: MS2 170 022 626
Facility: Naval Construction Battalion Center .

This permit is issued by the United States Environmental Protection Agency (EPA) under authority of the Resource Conservation and Recovery Act Subtitle C, 42 U.S.C. §§6921-6931 (1976, Supp. IV 1980 and Hazardous and Solid Waste Amendments of 1984) (RCRA) and EPA regulations to the United States Air Force and the United States Navy (hereafter called the Permittees), to operate a hazardous waste research, development and demonstration facility located in Gulfport, Mississippi at the Naval Construction Battalion Center (NCBC) at latitude 30° 18' and longitude 89° 12'. The project will test incineration and chemical treatment as a waste treatment process to decontaminate soils that are contaminated with dioxin from Herbicide Orange.

The Permittees must comply with all terms and conditions of this permit. This permit consists of the conditions contained herein (including those in the attachments) and the Regulations specifically contained in this permit.

This permit is based on the assumption that the information submitted in the permit application attached to the Permittee's letter dated January 29, 1986, as modified by subsequent amendments dated April 2, 1986 and May 9, 1986 (hereafter referred to as the application) is accurate and that the facility will be constructed and operated as specified in the application. Any inaccuracies found in this information may be grounds for the termination or modification of this permit (see 40 C.F.R. §270.41, §270.42 and §270.43) and potential enforcement action (42 U.S.C. §6925(g)). The Permittees must inform EPA of any deviation from or changes in the information in the application which would affect the Permittee's ability to comply with the applicable regulations or permit conditions.

A modification to this permit, as public noticed on June 8, 1988, changed permit Condition III.C. from 11,000 cubic yards to 14,000 cubic yards.

A modification to this permit, as approved in EPA's letter dated September 15, 1988, to the permittee, change permit Condition III.C. from 14,000 to 15,300 cubic yards and added thirty (30) operational days.

This permit is effective as of August 4, 1987, and shall remain in effect until August 4, 1989, and shall not exceed 280 operating days after commencement of experimental treatment. This permit may be revoked and reissued, or terminated in accordance with 40 C.F.R. §270.41, §270.43 or §270.65.

9/15/88
Date

Patrick M. Tobin
Signature
Patrick M. Tobin, Director
Waste Management Division

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PART I - STANDARD CONDITIONS

A. EFFECT OF PERMIT

This permit authorizes only the research on hazardous waste treatment expressly described in this permit and does not authorize any other management of hazardous waste. EPA will consider compliance with the terms of this permit to be compliance with requirements of RCRA Subtitle C and EPA regulations concerning the management of hazardous waste listed or described in this permit. Issuance of this permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local law or regulations. Compliance with the terms of this permit does not constitute a defense to any order issued or any action brought under Section 3013 or Section 7003 or RCRA, Section 106(a), 104, or 107 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 et seq., commonly known as CERCLA), or any other law providing for protection of public health or the environment.

B. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated for cause as specified in 40 C.F.R. §270.41, §270.42, §270.43, §270.65 and 42 U.S.C. Section 6925(g). The filing of a request for a permit modification, revocation and reissuance, or termination or the notification of planned changes or anticipated noncompliance on the part of the Permittees does not stay the applicability or enforceability of any permit condition.

C. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

D. PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The Regional Administrator may order an immediate termination of all operations under this permit at any time he determines that termination is necessary to protect human health and the environment (42 U.S.C. §6925(g)).

E. DEFINITIONS

For the purpose of this permit, terms used herein shall have the same meaning as those in Title 40 of the Code of Federal Regulations (40 C.F.R. Parts 260 through 264 and 270), unless this permit specifically states otherwise; where terms are not otherwise defined, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term. "Regional Administrator" is the Regional Administrator of the United States Environmental Protection Agency for Region IV.

F. REPORTS, NOTIFICATIONS, AND SUBMISSIONS TO THE REGIONAL ADMINISTRATOR

All reports, notifications or other submissions which are required by this permit to be sent or given to the Regional Administrator should be sent certified mail or given to:

U.S. Environmental Protection Agency
Director, Waste Management Division
345 Courtland Street, N.E.
Atlanta, GA 30365
(404)347-3454

G. SIGNATORY REQUIREMENTS

All reports or other information requested by the Regional Administrator shall be signed and certified as required by 40 C.F.R. §270.11.

H. DOCUMENTS TO BE MAINTAINED AT THE FACILITY SITE

The Permittees shall maintain at the facility, until closure is completed and certified by an independent registered professional engineer, the following documents and amendments, revisions and modifications to these documents:

1. Research plan as specified in this permit Attachment I.

2. Personnel training documents and records required by applicable portions of 40 C.F.R. §264.16 and this permit.

3. Emergency response plan required by this permit.

4. Closure plan required by applicable portions of 40 C.F.R. §264.112 and this permit.

5. Operating record required by applicable portions of 40 C.F.R. §264.73 and this permit.

6. Inspection schedules and logs required by applicable portions of 40 CFR §264.73 and this permit.

I. DUTIES AND REQUIREMENTS

1. Duty to Comply. The Permittees shall comply with all conditions of this permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit. Any other permit noncompliance constitutes a violation of RCRA and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or denial of a permit renewal application.

2. Need to Halt or Reduce Activity Not a Defense. It shall not be a defense for the Permittees in an enforcement action to argue that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. CFR §264.15 and this permit.

3. Duty to Mitigate. In the event of noncompliance with this permit, the Permittees shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment.

4. Proper Operation and Maintenance. The Permittees shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittees to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facility or similar systems to maintain compliance with the conditions of the permit.

5. Property Rights. The permit does not convey any property rights of any sort, or any exclusive privilege.

6. Duty to Provide Information. The Permittees shall furnish to the Regional Administrator, within a reasonable time, any relevant information which the Regional Administrator may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The Permittees shall also furnish to the Regional Administrator, upon request, copies of records required to be kept by this permit.

7. Inspection and Entry. The Permittees shall allow the Regional Administrator, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

   a. Enter at reasonable times upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

   b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

   c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

d. Sample or monitor, at reasonable times for the purposes of assuring permit compliance or as otherwise authorized by RCRA, any substances or parameters at any location.

8. Monitoring and Records.

a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity in accordance with Attachment I.

b. The Permittees shall retain the final project report and records of all data used to complete the application for this permit for a period of at least three years from the date of the sample, measure ment, report, or application. These periods may be extended by request of the Regional Administrator at any time and are automatically extended during the course of any unresolved enforcement action regarding this facility.

c. Records of monitoring information shall specify:

(1) The dates, exact place, and times of sampling or measurements;

(2) The individuals who performed the sampling or measurements;

(3) The dates analyses were performed;

(4) The individuals who performed the analyses;

(5) The analytical techniques or methods used; and

(6) The results of such analyses.

d. The sampling protocol for the treated soil residues must be submitted to EPA for review and approval prior to sampling.

9. Reporting Planned Changes. The Permittees shall give notice to the Regional Administrator as soon as possible of any planned physical alterations or additions to the permitted facility. This notice must include a description of all incidents of noncompliance reasonably expected to result from the proposed changes.

10. Certification of Construction or Modification. The Permittees may not commence incineration or chemical treatment of hazardous waste at the facility until:

a. The Regional Administrator has inspected the modified or newly constructed facility and finds it is in compliance with the conditions of the permit; or

b. The Regional Administrator has either waived the inspection or has not within 72 hours notified the Permittees of his intent to inspect.

11. Anticipated Noncompliance. The Permittees shall give advance notice to the Regional Administrator of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

12. Twenty-Four Hour Reporting. The Permittees shall report to the Regional Administrator any noncompliance which may endanger health or the environment. Information shall be provided orally within twenty-four (24) hours from the time the Permittees become aware of the circumstances. This report shall include the following:

    a. Information concerning release of any hazardous waste that may cause an endangerment to public drinking water supplies.

    b. Any information of a release or discharge of hazardous waste, or of a fire or explosion from the hazardous waste research, development, and demonstration facility, which could threaten the environment or human health outside the facility. The description of the occurrence and its cause shall include:

        (1) Name, address, and telephone number of the owner or operator;

        (2) Name, address, and telephone number of the facility;

        (3) Date, time, and type of incident;

        (4) Name and quantity of material(s) involved;

        (5) The extent of injuries, if any;

        (6) An assessment of actual or potential hazard to the environment and human health outside the facility, where this is applicable; and

        (7) Estimated quantity and disposition of recovered material that resulted from the incident.

    A written submission shall also be provided to the Regional Administrator within five (5) days of the time the Permittees become aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the periods of noncompliance (including exact dates and times); if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The Permittees need not comply with the five (5) day written notice requirement if the Regional Administrator waives that requirement and the Permittees submit a written report within fifteen (15) days of the time the Permittees become aware of the circumstances.

13. Other Noncompliance. The Permittees shall report all other instances of noncompliance not otherwise required to be reported above, at the time monitoring reports are submitted. The reports shall contain the information listed in permit condition I.12.

14. Other Information. Whenever the Permittees become aware that they have failed to submit any relevant facts in the permit application, or submitted incorrect information in a permit application or in any report to the Regional Administrator, the Permittees shall promptly submit such facts or information to the Regional Administrator.

15. Transfer of Permit. This permit may not be transferred to a new owner or operator.

J. COMPLIANCE SCHEDULE

The following information shall be submitted to the Regional Administrator before incineration of hazardous waste.

1. The Spill Prevention Control and Countermeasures Plan (SPCC) for the facility. The SPCC shall address but not be limited to the following:

   a. Spill prevention from hazardous waste staging and processing, solid residuals staging, and scrubber effluent staging.

   b. Spill containment from waste staging and processing units, effluent staging units, the MWP-2000 unit.

   c. Spill clean-up and rainwater disposition.

   d. Recordkeeping and Reporting.

2. The Statement of Work for Sampling and Analysis.

3. The Standard Operation Procedures specified on page 5-2 of Attachment I.

4. Telephone numbers and names of the emergency coordinators as described in Attachment IV.

PART II - GENERAL FACILITY CONDITIONS

A. DESIGN AND OPERATION OF FACILITY

The Permittees shall maintain and operate the facility to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste constituents to air, soil, or surface water which could threaten human health or the environment.

B. RESEARCH PLAN

The Permittees shall follow the procedures described in the attached research plan, Attachment I.

C. GENERAL INSPECTION REQUIREMENTS

The Permittees shall follow the inspection plan set out in the inspection schedule, Attachment II. The Permittees shall remedy any deterioration or malfunction discovered by an inspection as required by 40 C.F.R. §264.15(c). Records of inspections shall be kept as required by permit condition G.I.c.

D. PERSONNEL QUALIFICATIONS

The Permittees shall ensure that personnel are qualified to manage hazardous waste as provided in Attachment III. This training program shall follow the attached outline, Attachment III. All personnel involved with activities under this permit shall receive this training prior to initiation of activities under this permit as described in the attached outline, Attachment III.

E. PREPAREDNESS AND PREVENTION

1. Required Equipment. At a minimum, the Permittees shall equip the facility with the equipment set forth in the emergency response plan, Attachment IV.

2. Testing and Maintenance of Equipment. The Permittees shall test and maintain the equipment specified in the previous permit condition and in Attachment IV as necessary to assure its proper operation in time of emergency.

3. Arrangements With Local Authorities. The Permittees shall maintain arrangements with State and local authorities as required by 40 C.F.R. §264.37. If State or local officials refuse to enter into or renew existing preparedness and prevention arrangements with the Permittees, the Permittees must document this refusal in the operating record.

F. EMERGENCY RESPONSE PLAN

1. Implementation of Plan. The Permittees shall immediately carry out the provisions of the emergency response plan, Attachment IV, and follow the applicable emergency procedures described by 40 C.F.R. §264.56 whenever there is an imminent or actual fire, explosion, or release of hazardous waste or constituents which threatens or could threaten human health or the environment.

2. Copies of Plan. The Permittees shall comply with the requirements of 40 C.F.R. §264.53.

3. Amendments to Plan. The Permittees shall review and immediately amend, if necessary, the emergency response plan, as required by 40 C.F.R. §264.54.

4. Emergency Coordinator. The Permittees shall comply with the requirements of 40 C.F.R. §264.55.

G. RECORDKEEPING AND REPORTING

1. The Permittees shall maintain a written operating record at the facility in accordance with 40 C.F.R. §264.73(a). The operating record must be maintained until closure of the facility and shall include the following:

   a. The location of each hazardous waste within the facility and the quantity at each location.

   b. Records and results of waste analyses performed as specified in Attachment I and the statement of work to be submitted under permit condition I.J.2.

   c. Records and results of inspections required by permit condition II.C.

   d. Monitoring, testing, or analytical data as specified in Attachment V.

   e. The documentation required under permit condition II.E.3 if applicable.

H. CLOSURE

1. Performance Standard. The Permittees shall close the facility in accordance with the closure plan, Attachment VI. In addition, the incinerator shall be operated on natural gas at the operating conditions specified in permit condition III.E. for two (2) days (48 hours) during closure to ensure contaminated soil is not left in the system.

2. Amendment to Closure Plan. The Permittees shall amend the closure plan in accordance with 40 C.F.R. §264.112(b) whenever necessary.

3. Notification of Closure. The Permittees shall notify the Regional Administrator at least 15 days prior to the date he expects to begin closure.

4. Time Allowed for Closure. After treating the final volume of hazardous waste, the Permittees shall treat or remove from site all hazardous waste and shall complete closure activities within 180 days of notification of closure in accordance with the closure plan, Attachment VI.

5. Disposal or Decontamination of Equipment. The Permittees shall decontaminate and/or dispose of all facility equipment as required by 40 CFR §264.114 and the closure plan, Attachment VI.

6. Certification of Closure. The Permittees shall certify that the facility has been closed in accordance with the specifications in the closure plan, Attachment VI, as required by 40 CFR §264.115.

I. EXPERIMENTAL PROCEDURES

1. The Permittees shall follow the experimental procedures set forth in Attachment I.

2. The Permittees shall handle all scrubber waters from the incinerator as described in Attachment VII.

3. The Permittees shall handle all treated soil from the incinerator as specified in Attachment VIII.

   a. Soil samples shall be obtained as specified in Appendix B of Attachment VIII.

   b. Within one (1) week of operation, a 24-hour composite sample of treated soil shall be analyzed for the parameters outlined in Attachment 4-A of Attachment XI. The analysis in Attachment 4-A shall be repeated each 30 days following the initial analysis. Sample procedures shall be those specified in Appendix B of Attachment VIII. Footnote "e" of Attachment 4-A shall be complied with by following the analytical methods specified in Attachment 4-B, (Attachment 4-B is in Attachment XI).

PART III - INCINERATOR TREATMENT

III.A. CONSTRUCTION

The Permittees shall construct and maintain the incinerator in accordance with the attached plans and specifications, Attachment I.

III.B. PERFORMANCE STANDARD

The Permittees shall construct and maintain the incinerator so that, when operated in accordance with the operating requirements specified in this permit, it will meet the following performance standards.

1. The incinerator must achieve a destruction removal efficiency (DRE) of 99.9999% for 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) and dibenzofuran.

2. The Permittees must control hydrogen chloride (HCl) emissions, such that the rate of emissions is no greater than the larger of either 1.8 kg/hr or 1% of the HCl in the stack gas prior to entering any pollution control equipment.

3. The incinerator must not emit particulate matter in excess of 180 milligrams per dry standard cubic meter when corrected for the amount of oxygen in the stack gas in accordance with the formula specified in 40 CFR §264.343(c).

4. Compliance with the operating conditions specified in this permit will be regarded as compliance with the above performance standards. However, evidence that compliance with such permit conditions is insufficient to ensure compliance with the above performance standards may be "information" justifying modification, revocation or reissuance of the permit pursuant to 40 CFR §270.41.

III.C. MAXIMUM WASTE TO BE TREATED

The Permittee may treat up to 11,000 cubic yards of material identified in permit Condition III.D.

III.D. LIMITATION ON WASTES

The Permittees shall treat with incineration the following hazardous wastes:

Waste Code Number	Description	Feed Rate
F027	Soil contaminated with Herbicide Orange	0-5.3 tons/hr

Miscellaneous combustible (wooden pallets) and noncombustible (concrete/ drums) refuse present on the storage area. Residues and equipment resulting from chemical treatment described in Attachment I.

III.E. OPERATING CONDITIONS

The Permittees shall feed the waste described in Condition III.D. to the incinerator only under the following conditions:

1. The rotary kiln temperature, as measured by the outlet gas thermocouple (TE-121), shall be maintained above 1450°F.

2. The secondary combustion chamber temperature, as measured by the outlet gas thermocouple (TE-223), shall be maintained above 2150°F.

3. The secondary combustion chamber residence time, calculated from Equation 16 in Attachment X, shall be maintained above 1.65 seconds.

   a. The soil feed rate in lbs/hr shall be calculated and input to the Data Aquisition System (D.A.S.) each 8-hour shift.

   b. The soil moisture content shall be measured with the infrared analyzer, as described in Attachment X. If the infrared device fails, then moisture content shall be calculated and input to the D.A.S. each 8-hour shift using ASTM Method D2216-80.

4. Maximum stack gas carbon monoxide (CO) concentration, measured as specified in Attachment I, shall not exceed 50 ppm for more than six (6) minutes accumulative every clock hour, or 500 ppm maximum at any time.

5. Maximum auger speed, measured at the auger hydraulic motor gear (SE-137), shall not exceed 5.8 rpm.

6. Packed tower scrubber water recirculation flowrate, measured at the distribution headers (FE-415) shall be maintained above 132 gallons/minute.

7. Ejector scrubber water recirculation flowrate, measured at the ejector scrubber inlet (FE-422), shall be maintained above 35 gallons/minute.

8. Kiln pressure, as measured at the exit of the kiln (PT-124) shall not exceed -0.05 inches of water for more than 15 seconds.

9. The Permittees shall operate the incinerator to immediately cut off hazardous waste feed when any of the following occur:

   a) Kiln temperature, as measured in Condition III.E.1. falls below 1450°F.

   b) Secondary combustion temperature as measured in Condition III.E.2. falls below 2150°F.

   c) Residence time, as calculated in Condition III.E.3. falls below 1.65 seconds.

   d) Stack gas carbon monoxide (CO) level, as measured in Condition III.E.4. exceeds 50 ppm for more than 6 minutes accumulative every clock hour, or 500 ppm maximum at any time.

   e) Maximum auger speed, as measured in Condition III.E.5., exceeds 5.8 rpm.

   f) Packed tower scrubber water recirculation flowrate, measured in Condition III.E.6., falls below 132 gallons/minute.

   g) Ejector scrubber water recirculation flowrate measured in Condition III.E.7., falls below 32 gallons/minute.

   h) Kiln pressure, measured in Condition III.E.8. exceeds -0.05 inches of water for more than 15 seconds.

   i) The Data Aquisition System (D.A.S.) fails and cannot calculate residence time.

   j) The following incinerator monitoring equipment fails:

      1. Thermocouple TE-121
      2. Thermocouple TE-223
      3. O_2 analyzer
      4. CO analyzer
      5. Kiln natural gas flow meter
      6. Secondary combustion chamber natural gas meter

   k. The solids feed weigh hopper fails and cannot be fixed within 15 minutes.

10. During start-up and shut-down of the incinerator, hazardous waste must not be introduced into the incinerator unless the incinerator is operating within the conditions specified in Conditions III.E.1. through 8.

11. The Permittees shall monitor the facility, as specified in Attachment I.

12. In the event of loss of flame in the secondary combustion chamber, the Permittees must restore flame within three (3) minutes. Temperature in the SCC must be maintained at 2150°F until all* solids exit the kiln.

13. The CO and O_2 continuous emission monitors shall be calibrated daily with zero and span gases. Zero gas shall be 0 to 10% of full scale and span gas shall be 80 to 100% of full scale.

III.F. THERMAL RELIEF VENT

The thermal relief vent shall only be used in emergency situations which could endanger downstream pollution control equipment and only after all waste feeds have been cut off. The following failure modes are emergency situations where the Permittees may use the thermal relief vent:

1. Steam drum water level on the waste heat boiler falls to zero (0) percent.

2. Exit temperature of the waste heat boiler, as measured by thermocouple TE 409, exceeds 600°F.

3. Inlet temperature of the packed tower, as measured by thermocouple TE 321, exceeds 220°F.

The Permittees shall minimize emissions during a TRV event by maintaining temperature in the secondary combustion chamber at 2150°F until all* solids exit the kiln. Within 24 hours after an event in which the thermal relief vent is opened, the Permittees shall be required to verbally report the incident to the Regional Administrator. A written report will be required within fifteen (15) days to explain the reason for the incident and actions being taken to prevent the situation from recurring. If the TRV is opened for any reason other than the three (3) failure modes listed above, the Permittees shall not be allowed to resume feeding hazardous waste to the incinerator until approval is received from the Regional Administrator.

*The requirement for all solids to exit the kiln shall be considered met if kiln rotation is maintained at or above 4.5 rpm for twenty (20) minutes.

III.G. AMBIENT AIR MONITORING PLAN

1. The Permittees shall follow the ambient air monitoring plan outlined in Attachment IX.

2. The Permittees must immediately stop excavation if PUF Sampler C exceeds the 2,3,7,8-TCDD action level of 3 pg/m^3 as described on page 18 of Attachment IX. The Permittees may not resume excavation until approval is received from the Regional Administrator if the action level is exceeded.

III.H. SUBMITTAL OF INTERIM REPORTS

1. The Permittees shall evaluate bulk average waste feed rate (as measured by the weigh hopper) versus auger rpm for the first fourteen (14) days of operation. This data shall be submitted to the Regional Administrator within ten (10) days of compliance. The data will be used to evaluate the accuracy of auger rpm as the indicator of waste feed rate (Condition III.E.5.).

2. The Permittees shall continue ambient air monitoring with the PUF samplers as described in Section 3.3.2 of Attachment IX until the Regional Administrator approves the summary report and revised sampling plan described on page 24 of Attachment IX.

3. The Permittees shall submit the waste feed moisture analysis comparison data described in Attachment X within five (5) days.

4. The Permittees shall submit results from the treated soil analyses under Condition II.I.3.b. within fourteen (14) days of the analysis.

PART IV - CHEMICAL TREATMENT

A. CONSTRUCTION AND MAINTENANCE

The Permittees shall construct and maintain the chemical treatment units in accordance with the attached design plans and specifications, Attachment I.

B. MAXIMUM WASTE TO BE TREATED

The Permittees shall not chemically treat more than 12 cubic yards of soil which has been contaminated with dioxin from Herbicide Orange from NCBC, Gulfport, Mississippi during the term of this permit.

C. OPERATING CONDITIONS

1. The Permittees shall conduct the chemical treatment in accordance with the test procedures outlined in Attachment I.

2. Test 1. Slurry Process shall take place in Zone 1 and/or Zone 2 of the regulated area described in Attachment I.

D. CLOSURE AND WASTE DISPOSAL

The Permittees shall dispose of all residues and equipment resulting from chemical treatment in the incinerator. During disposal, the incinerator shall be operated as specified in permit Condition III.E.

PART V - TEST DATA SUBMISSION

The Permittees shall submit a copy of all preliminary data collected during the tests to the Regional Administrator upon completion of the tests. The Permittees shall submit the draft and final reports for the incinerator and chemical treatment research projects as soon as such reports become available, but not later than one (1) year from the expiration date of this permit. If the reports are not completed at this time, the Permittees shall report monthly thereafter on the status of the reports. All submissions must be certified in accordance with 40 CFR §270.11. The Permittees shall make the raw data available to EPA upon written request.